Vol. XXII, No. 5
OCTOBER 1955

THE SCIENCE TEACHER

JOURNAL OF THE NATIONAL SCIENCE TEACHERS ASSOCIATION

Speaking of General Science . .

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conservation
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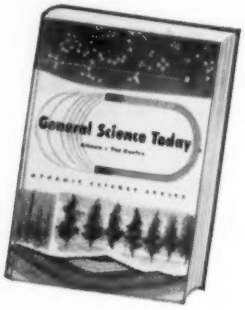

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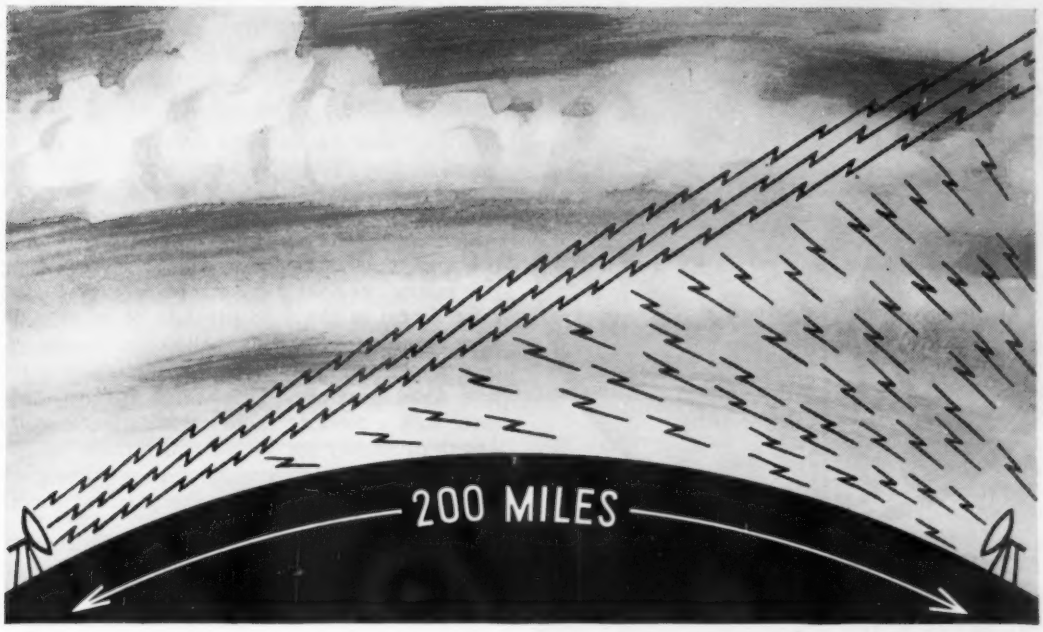

Highly schematic drawing shows possible distribution of energy in ultra-high-frequency "over-the-horizon" transmission. Effect is similar to that of a powerful searchlight whose beam points into the sky. Light can be seen miles away from behind a hill even when searchlight lens is invisible.

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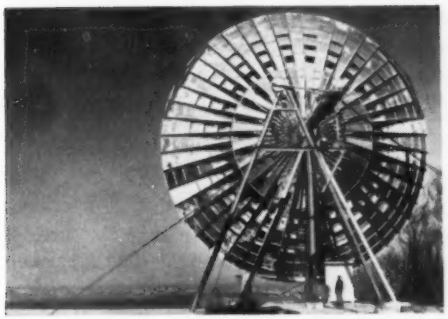

This experimental 60-foot antenna (rear view) photographed at the Bell Telephone Laboratories in Holmdel, New Jersey, is designed for study of "over-the-horizon" phenomena.

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THIS MONTH'S COVER . . . Who's behind the wheel of science in the schools of America? Elementary teachers, as well as high school teachers, and college instructors! We present our cover as a tribute to those persons NSTA serves in its effort to bring teachers at all levels toward a common goal—the improvement of science instruction. We hope the pages of *TST* will help those persons behind the wheel drive down another school year with enthusiasm and effectiveness.

Readers' Column

Dear Sir:

I'm 12 years old going into the 8th grade, and very interested in science. I take a little time out of every day for my study. At the moment I am specializing in mineralogy, and a touch of chemistry and atomic energy. I hope to become a science teacher or scientist. Either way, I'll do my best. That is why I am writing to you.

I'm running low on information, which is important, if I'm going to complete my studies, and "theories." Will you please send me any publications or pictures of sciences, or anything else that might help. Thank you very much.

Gratefully yours,
MISS FRANCENE PELTONEN
Plymouth Rock, Massachusetts

Enclosed please find my payment for renewal of my membership in the Association. I have retired from active classroom work but still want to continue membership and receive *The Science Teacher* which I so much enjoy. Congratulations on the fine work the Association is doing and best wishes for continued service.

CORDELIA STILES
Milwaukie, Oregon

I wish to acknowledge receipt of your letter wherein you inform me that I have been selected to receive a First Award in the 1955 program of Science Achievement Awards for Students. Allow me to extend my sincere thanks and appreciation for the opportunity which your Association offered me as well as other students to enter such a contest. Your organization as well as the American Society for Metals which made this program possible should be congratulated in promoting scientific endeavor and thought among the youth of America.

ALFRED L. GOLDBERG
Providence, Rhode Island

Thank you very much for the beautiful Life Member certificate. I shall have it framed and hang it in my chemistry laboratory. I hope my students will become as familiar with this certificate as they do those of other professional organizations that you see hanging in the offices.

I've taught quite a number of years. Among the best groups of students I've had are my present chemistry classes. I don't know where all this "deterioration of student body" is—but it isn't here. I do find that a number of forces are at work to discourage students studying mathematics/science that raise questions in one's mind.

ELMER A. FINCH
Amityville, New York

I wish to thank you for the many services I have received as a Sustaining Member. The special mailings you send are excellent and are widely used in our science department. The book, "Ford at Fifty," was in great demand, particularly by our boys in vocational classes.

MILDRED PARKER
Hutchinson, Kansas

Being an overseas member of the NSTA, I would like you to know how much I appreciate the Packet Service. It brings a lot of useful material and tells us quite a lot about your country. One day, perhaps, we might have some similar type of service out here.

ANNE MARTIN
Sydney, Australia

THE SCIENCE TEACHER

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Coming . . .

in the November issue of *The Science Teacher*

- Reflective Thinking as a Purpose in Science Teaching
- Science Demonstrations for Improved Learning
- Developing Science Atmosphere in Elementary Classrooms
- A Research Study in the Learning of High School Chemistry

Editor's Column

Has the U. S. Office of Education abdicated its role as the Federal Government's agency for *educational* responsibility in the field of science?

Five years ago the Office staff included six specialists in fields of science, and engineering. Today, only one and one-half remain—Dr. Paul E. Blackwood (half-time in elementary science education) and Dr. Henry H. Armsby (full-time in engineering education). At the secondary school level, there is only such attention as the Specialist for Mathematics (Dr. Kenneth E. Brown) can spare from other responsibilities.

First departure was the Specialist for College Physics—Dr. Bernard Watson, who went to the Operations Research Laboratory of Johns Hopkins University. Next was the re-assignment of Dr. W. Edgar Martin (biological science) to other, non-science activities. Two years ago Dr. Philip G. Johnson resigned to return to Cornell University to head up that institution's science education program. One year ago Dr. Glenn O. Blough followed suit, this time the University of Maryland being the lucky institution.

Meanwhile, concern about the extent and quality of high school science teaching grows wider and deeper. Professional societies in fields of science, engineering, and education and business-industry groups are providing an increasing number of aid programs. Within the government, the National Science Foundation has apparently been handed the ball and is trying—with good success—to score the touchdown.

Greatly needed, it seems to me, is vigorous and prompt resumption of USOE's traditional research and fact-finding activities in relation to science teaching in the high schools. Either the Office should hire a Specialist for Secondary School Science and let him get going, or else it should contract with one or more appropriate agencies to get some needed jobs done. USOE statistics on high school science enrollments and related topics are nearly ten years old (based on 1947-48 and published in 1950).

Actually there are no recent, reliable statistics on a nationwide basis to support (or to refute) such oft-quoted statements as: "Half the nation's high schools do not offer chemistry" and "The per cent of students taking physics has dropped from 19 to less than 5 per cent since 1900." (This latter statement is misleading and almost meaningless because the per cents are based on the total four-year enrollment; also because of the changes in the functions, curricula, and student population of highschools during half a century. Knowing the per cent of *graduates* having taken physics or the per cent of *capable* students who by-pass physical science and mathematics would be much more useful information.)

Better information and up-to-date statistics would help all the action groups to design more solid, more helpful aid programs. A USOE Specialist for Secondary School Science (an appointment almost promised for last July 1) is needed on the team.

Robert H. Carleton

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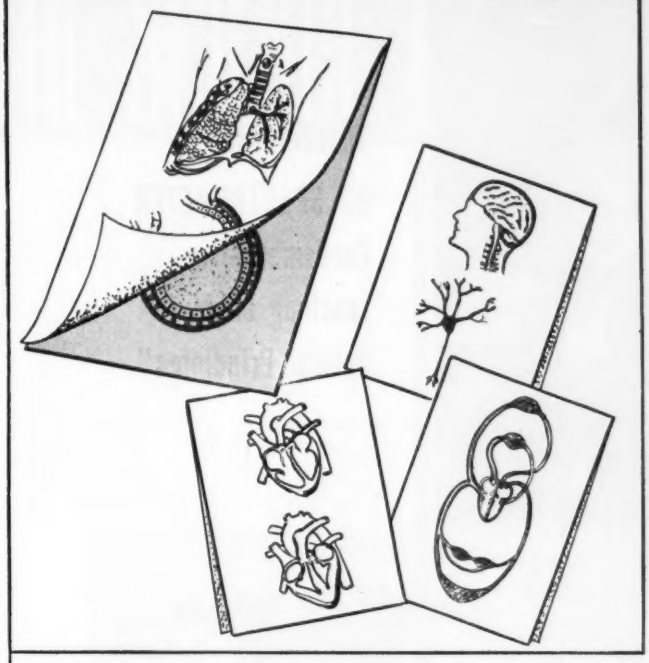

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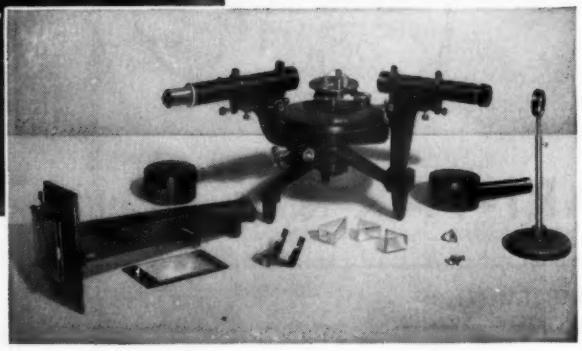

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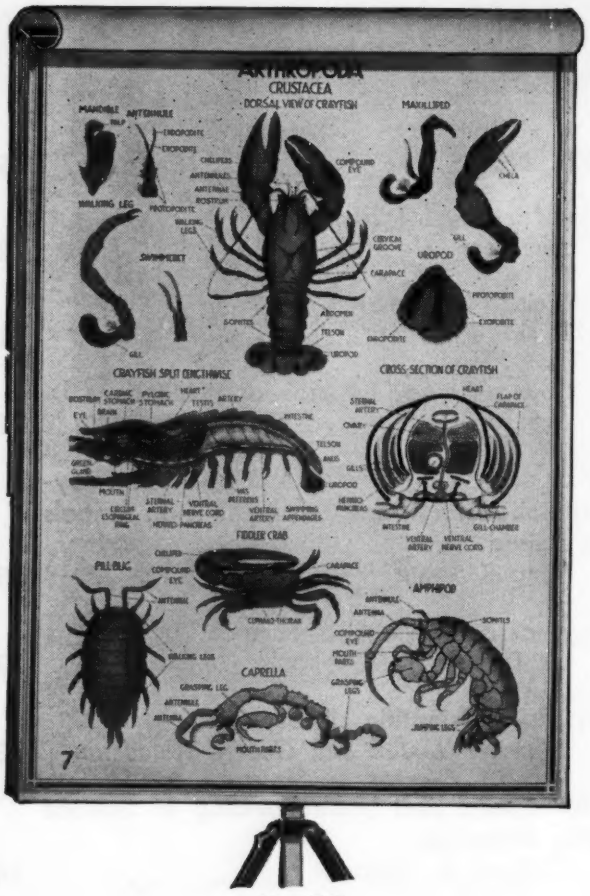

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Science and Intelligent Choice

By ROBERT J. HAVIGHURST

Professor of Education, The University of Chicago

IN THE EARLY YEARS OF THIS CENTURY science was identified by most people with progress and human betterment. People generally had the idea that the world was sure to get better as man's scientific knowledge increased.

Luther Burbank with his creation of new fruits for the dinner table, Thomas Edison with the electric light and the phonograph, E. E. Slosson with his book *Creative Chemistry* which showed the benefits of chemistry in the service of man, and then the wonder drugs of the biochemists—all were evidences in those optimistic years that a steadily rising standard of living and a bettering world would result from the extension and application of science.

In somber contrast to this early 20th-century optimism, many people are today affected with a profound skepticism about the values of science, and the earlier notion of inevitable progress through expansion of knowledge is now a shattered illusion. Science is identified with trouble as well as with betterment. The atomic bombs dropped from American planes on Nagasaki and Hiroshima stand in the eyes of a large part of the world as a sign that science may destroy the human race.

It is almost popular to be a modern Jeremiah. Albert Einstein told us that if he had his life to live over again he doubts that he would become a scientist. Walter Lippmann writes of the "precipitate and catastrophic decline of western society." Bertrand Russell, on the occasion of his 80th birthday, looks back and doubts that the world has grown any better during his lifetime. Perhaps, indeed, we of this century have failed in the complex business of living peaceably and constructively as societies and nations.

If we have failed in our century and in our part of the world, it is because we, as a society and a nation, have not made the right choices. It is not because we have suffered misfortunes due to drought, flood, or a new ice age. It is not because of something we could not possibly control, such as a collision of our earth with a large asteroid. It is because we have not used our resources, our power, and our knowledge wisely enough.

Some people might argue that we, in our part of the world, have not been really free to choose. They might argue that some uncomfortable choices have been forced upon us by our foreign competitors. If we were in the position of the horse thief who was given his choice between being hanged with a rope or with a buckskin belt, we might not appreciate the opportunity. What is the value in choosing between two equally bad alternatives? But I cannot agree that our actions as a nation, either in foreign or domestic affairs, have been dictated or determined by the actions of our adversaries in the cold war, though of course our actions have been partially a response to actions of other nations. If any nation has been free to choose, to take the initiative, in its foreign or domestic policy during the 20th century, that nation is surely the United States of America.

What Is Intelligent Choice?

Intelligent choice is an activity with three aspects:

1. Recognizing that a choice may be made among possible alternatives.

An address delivered March 24, 1955, to the National Science Teachers Association at its Third National Convention, Cincinnati, Ohio.

2. Foreseeing the consequences of action along each of the alternative lines.
3. Choosing the better of the alternatives.

When a person buys an automobile, or a suit of clothes, his behavior usually demonstrates these aspects of the choice-making process. It seems that when the choice concerns some tangible object, intelligent choice-making proceeds more easily than when it concerns a less tangible object.

For example, the elements of intelligent choice are more likely to be well followed in buying clothes than in choosing a candidate for Congress. Even such highly personal choices as choosing a vocation and choosing a mate are likely to be made with less consideration of possible alternatives than the more limited choices of where to go for a vacation or what kind of a house to rent. This is partly because the consequences of the vocational and mate choices are more far-reaching and more emotion-laden than the consequences of the latter choices. One has strong emotional impulsions to the deeper personal choices.

We have been thinking about personal choices, great and small. But there are also societal choices which we make, directly or through our representatives.

> Should the United States have entered the League of Nations after World War I?
>
> Was it a wise choice to drop the A-Bomb on Hiroshima and Nagisaki?
>
> Should Congress have passed the McCarran Subversive Activities Control Bill over President Truman's veto?
>
> Should we have rigid or flexible price supports for agricultural commodities?

These choices which we make in collaboration with other citizens, we know are as important for us as individuals as are the more personal choices which we make alone with ourselves.

The Importance of Active Choice in the Modern World

It is hardly more than a truism to say that choices are more far-reaching in the modern world than they were in a simpler society with a simpler technology. When the farmer of the midwest a century ago chose to plant corn or wheat, to keep one team of horses or two, to vote Whig or Democrat, to start his son on a new farm or to let him read in a lawyer's office in town, he was making choices which affected his own family and, in a limited way, his community and his nation. But the midwestern farmer of today chooses whether to plant corn or soybeans in the light of the world market and in terms of the government agricultural program; he chooses whether to buy a new tractor, a new automobile, or a corn-picker, and in so doing he affects the welfare of a million workers in the industrial centers of the nation; he chooses whether to vote Democrat or Republican, and in so doing he affects the lives of people in Germany and Japan; he chooses whether to encourage his son to stay on the farm or to go to the University and take an engineering degree which will carry him to a career in some far corner of the world. This present-day farmer has a longer reach with his choices. He controls many iron horses where his great grandfather had only three or four on the hoof. He must choose, and choose actively. He cannot sit back and allow the seasons with their duties to determine the major doings of his life.

The complexity of men's choices has grown, while the quality of these choices has not improved very much, and perhaps has grown worse.

How can men improve the quality of their choices? Does scientific knowledge or scientific attitude affect the quality of one's choices? What areas of choice are most affected by science?

The Functions of Science in Choice Making

There are two possible ways by which science can improve the quality of choice. One is to *provide information* on the basis of which better choices can be made. For instance, weather forecasting permits people to choose more intelligently what their work or travel plans should be for the next few days. Vocational choice is made more satisfactory by the scientific knowledge available on aptitudes and interests of people in relation to vocational success. Population policy for a nation or a society can be determined and executed more efficiently through using scientific knowledge concerning the relation of population to other factors and through scientific knowledge concerning birth control. Consumers can choose automobiles and washing machines and brands of canned food more wisely by using scientific knwoledge concerning the qualities of these products of modern technology.

The other way by which science can improve the quality of choices is to teach people a *method* of making better choices. Through science we have learned to make better choices in the construction of machines of all kinds, in the growing of grain and fruit and vegetables, in the breeding of animals. We have learned to make better choices in these areas because we have learned a method of approaching and studying problems.

But perhaps we are no wiser in our choices in

more complex situations, and in situations which involve intangible rather than material values.

Still, I am convinced that we must rest the case for the importance of science in intelligent choice on the advantages that science will give us in our *methods* of choice-making, as well as on the advantages that we get from scientific information.

If I had made this statement 20 years ago to a group of science teachers, or to almost any group of thoughtful men and women, I think they would have agreed with it. But now, there is surely widespread disagreement with this kind of statement. Because we have failed to make the right choices on momentous occasions, because people now doubt the inevitability of progress, there is a strong current of doubt over the possibility of using the scientific method in the great affairs of life. It is said that this method is no more than a tool to help people act efficiently in their technology—it may be good for splitting the atom, but not for deciding how to use atomic energy.

There are many people who say that we cannot trust man's reason, fortified by the scientific method, to do the basic job of decision-making today.

As science teachers we now stand at a crucial point. We are being called upon to give up the old claims about the applicability of the scientific method in the political, economic, and social affairs of men, and to restrict ourselves to teaching technology and the theory underlying technology.

In a sermon entitled "Christ is Coming," evangelist Billy Graham speaks of the possibility of the destruction of life on the planet by modern scientific weapons, and says,[1] "There is a growing universal awareness that, as a society, we have our backs to the wall and that the storm is about to break in all its fury. . . . We as a race have reached the end of our illusive humanistic dreams. There will still be progress, but it must be God's kind of progress. . . . We need not lose faith, but we must transfer our faith from man and his progress to God and His progress." He goes on to cite the biblical predictions of the second coming of Christ, and says, "There is no possibility that the nations of the world will solve the basic problems of human nature until Christ comes again."

If this means anything, I suppose it means that Billy Graham believes that man's reason, aided by the tools of science, is unable to cope with the complexities of the world today.

There is another group who also mistrust human reason and who have a strong appeal to a substantial section of America. I shall call them the neo-conservatives. They like to call themselves conservatives, but that is too good a name to be monopolized by this group. They go back to Edmund Burke and Lord Disraeli, the great leaders of British Conservatism when it was at its height. They come on down through academic voices such as Professor Irving Babbitt and Paul Elmer More, to a contemporary spokesman such as Professor Russell Kirk whose book, *The Conservative Mind,* has met with considerable approval in certain American circles today.

Essentially, this group of people tell us that we have made a mess of things in this century, and the cause is that we have relied too much on man's reason and man's experimenting with new ways of conducting human affairs. They call on us to go back to Tradition, back to a more aristocratic order of society, and to find in the 18th century the cure for our 20th century problems. Kirk sets out six *canons* of conservative thought for today, of which the last two are:[2]

> Faith in prescription and distrust of "sophisters and calculators." Man must put a control upon his will and appetite, for conservatives know man to be governed more by emotion than by reason. Tradition and sound prejudice provide checks upon man's anarchic impulse.
>
> Recognition that change and reform are not identical, and that innovation is a devouring conflagration more often than it is a torch of progress.

Let us recognize at once that there is much truth in this conservative criticism of present-day-society. But there is peril in the neo-conservative solution for our problems. It is true that men are governed more by emotion than by reason. But what is to be done about this? The neo-conservative proposal is that we return to tradition, prejudice, and prescription in place of trying to build up men's reason.

Our proposal must be to build up man's reasoning powers through education and the tools of science.

The neo-conservative doctrine can be very attractive to people who are disillusioned about the probability of progress, unhappy over recent social and political changes, and uncomfortable about the world we live in today. But it is a dangerous doctrine—this mistrust of man's reason and reason's tools of science and mathematics.

Tradition will not guide us to choose intelligently in a changing world. Prejudice will not help us to meet the situations we shall encounter in a world that is in revolution against the aristocratic, colonial,

[1] "Christ Is Coming." Minneapolis, Billy Graham Evangelistic Association, 1955.

[2] Russell Kirk, *The Conservative Mind,* pp. 7-8. Chicago. Henry Regnery Company, 1953.

and ethnocentric preconceptions of the 18th and 19th centuries. Prescription—who is to prescribe what men should believe in the twentieth century?

Science stands for the active human intelligence applied to the problems of today and tomorrow. Science can accept and make use of the experience of the past, which is tradition, but science depends much more on the experience of the present reality.

The Science Teacher and the Problem of Intelligent Choice

The science teacher at any level—elementary school to graduate school—is always doing three things simultaneously. He is teaching knowledge relevant to some goal, he is teaching or illustrating a method of gaining knowledge, and he is exemplifying an *attitude toward action,* or *choice-making.*

As a teacher of knowledge the science teacher must be concerned with what knowledge is relevant to the goals of education, and recognize a variety of goals, ranging from the choice of and preparation for an occupation to the goals of competent citizenship and a sound philosophy of life. The test of relevance is whether the knowledge is useful for important choices which people must make.

As one who is teaching or demonstrating a method of gaining knowledge, the science teacher should show where this method applies and also what its difficulties are in complex non-laboratory situations.

As one who is exemplifying and teaching a way of making intelligent choices, the science teacher should work with students on the making of choices. He should work with them on discovering and formulating the criteria for wise choices.

Recently a teacher of civics told me how she was teaching her senior high school pupils to try to exercise intelligent choice in a local election. She asked them which mayoral candidate they were for, without indicating her own choice. Then she asked them to write their reasons for favoring one or the other candidate. Although the class gave a majority of four to one for one of the two candidates, their reasons for favoring their own choices showed a great overlapping. In other words, different students favored different candidates for the same reasons, such as "he will do a better job of garbage collection," "he will reduce crime," "he will reduce gambling," and there were others who said, "he will make gambling easier," and others who said, "he has seven children." Now she had a good teaching situation. Were these really their reasons for favoring one or the other candidate? If so, perhaps they had better study the candidates more carefully so as to choose more surely the one who would do the best job of crime reduction, or garbage collection, et cetera. Or were these reasons merely rationalizations after they had already chosen their candidate on some other, unexpressed basis?

This was good teaching about choice-making, and the science teacher can find many analogous opportunities, in connection with problems where scientific information as well as scientific attitudes are relevant to the choice. Such matters as:

Fluoridation of water supply
Cigarette smoking as a possible cause of lung cancer
Pros and cons of toll roads
Public versus private development of water power
The controversy over optimum population size

There are criteria for wiser choice-making, which the science teacher can teach and exemplify. They are:

1. Have the probable consequences of the alternative choices been explored as carefully as is reasonably possible?
2. Have the probable consequences of the alternative choices been evaluated against a scale of democratic ethical values?

In general, the science teacher can help his students get into the habit of looking for facts and reasoning about facts in making choices with respect to the major issues in human affairs. In doing this, he and his students will see that science is always the champion of reason and the enemy of tradition. Reason may use tradition, but tradition must not be permitted to dominate reason. Science stands for the active intelligence, guided by experience and tradition, and by observation of changing reality. The intelligent choice of 100 years ago is not always the intelligent choice of tomorrow.

If we do our jobs as science teachers, and if other people do their jobs, too, perhaps we may be optimistic about the future. Perhaps we may share the limited optimism of two of our scientific colleagues who stand at the end and the beginning of distinguished scientific careers.

Dr. Anton Carlson, speaking toward the close of a long and distinguished career, has said:[3] "I dream of a day when our leaders will actually put the principles of science and democracy to work in our land, in politics, in industry, in trade, in education; when understanding will more than hold its own against superstition, guile, and greed, when force is replaced by conference, compromise, and approximate justice in all our domestic and foreign

[3] A. J. Carlson, *Science,* V. 117, p. 701-3 (June 26, 1953) Address to the American Association for the Advancement of Science.

(Please continue on page 242)

TOWARD RACIAL INTEGRATION

By FRANK E. WOLF
Monroe-Woodbury High School, Monroe, New York

THE FOLLOWING SERIES of demonstrations and experiments is presented with a triple purpose. First, it is hoped that the procedures and outlines will be helpful to teachers who work in the general subject area covered. Second, it is hoped that more teachers will endeavor to work in the area covered, as a means of implementing the vast social integration which is due to follow the Supreme Court's May 17, 1954 ruling. Third, United States' foreign policy, as it relates to winning allies abroad, makes it imperative that we sweep before our own "racial" (more properly *ethnic*) doorstep. For if we are to earn the friendship of Asiatics and other peoples of color, we will have to exhibit greater understanding of these peoples. It is hoped that the following materials will help other teachers, as it has helped the writer, to teach for the attainment of better intercultural relations.

There are many questions concerning the efficacy of teaching factual material in order to alter the emotionalized prejudices. However, where the law provides penalties for discrimination, the manifestation of overt emotionalized prejudice is reduced. For the moment, the person, against whom emotionalized prejudice ordinarily results in discrimination, is less likely to be affected by the beliefs of others.

On the other hand, the intellectual prejudices, i.e., those due to social pressures, misinformation, lack of information, habit, superstition, ignorance of effect upon others, style or fad, and tradition or folklore, are likely to be altered by factual material presented in a democratic classroom atmosphere. On this theme, Danielson wrote, ". . . in teaching the importance of the use of the scientific method and the changes that have come about in society as a result of its use, the science teacher has an opportunity to indicate the number of areas in present living where racial superstitions still persist." [1]

Similarly, Denemark wrote, ". . . move students emotionally, yes, but accompany this by the clarification of the scientific base upon which such healthy attitudes rest." [2] Finally, Stagner gives this support to the view that prejudiced attitudes may be altered, ". . . attitudes are virtually pure effects of environment, hence are easily modified." [3], and ". . . traits are modified chiefly by learning new ways of perceiving and reacting to situations." [4]

In addition to the authorities quoted, the writer has had at least three successful experiences using the following materials. One such experience was in a New York City high school, where a child asked, "Teacher, how can we cure the disease of prejudice?" Last year in Burma, the writer had two opportunities to use these materials. One was in the writer's host high school in Bassein. The other was by request of a fellow Fulbrighter in Moulmein.

In Bassein, some students changed their prejudiced belief that a light-skinned Chinese girl had lighter blood than a darker-skinned Dravidian boy. In Moulmein, similar results were obtained when the question arose concerning the hemoglobin content of a darker-skinned Burmese who was a member of a sub-ethnic group—Mon, as compared with a lighter-skinned Burmese who was a Karen.

These examples of factual material changing persons' prejudices, to open-mindedness in light of overwhelming scientific factual material, create confidence in our endeavors toward racial integration.

To try to answer the question, "Are there discernible differences between the blood systems of different ethnic groups?", the following activities may be conducted.

I. Experiments and Demonstrations

A. Examination of white blood cells:

1. Volunteers from various ethnic groups, who have been prepared with letters from home, are given finger punctures.
2. A drop of blood is mixed on a slide with a drop of three percent acetic acid which has been lightly colored with crystal violet.
3. After standing on the slide for a few minutes, the blood is examined under the high power objective.
4. Different kinds of white blood cells will be observed in each sample and each type of white blood cell will be found in each sample.

[1] E. O. Danielson, and Others, "Emphases for Intergroup Education in Secondary School Science," *The Science Teacher*, XVI (February, 1949), p. 13.

[2] George W. Denemark, "School Versus Prejudice," *Educational Leadership*, VIII (December, 1950), pp. 144-148.

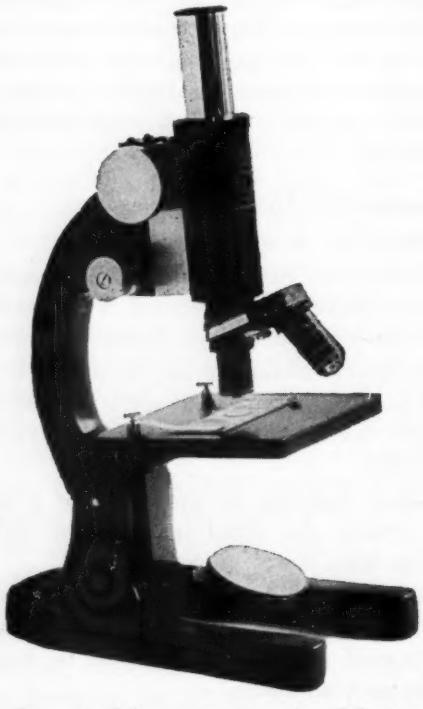
[3] Ross Stagner, *Psychology of Personality*, New York: McGraw-Hill, 1948, p. 162.

[4] *ibid*, p. 165.

B. Examination of red blood cells:
   1. Blood is drawn as above.
   2. A drop of blood is added to one cubic centimeter of physiological saline.
   3. One drop of the above cell suspension is placed on a slide under the microscope and allowed to stand for a few minutes.
   4. Meanwhile, a piece of paper is punctured to produce a small hole and is inserted in the ocular of the microscope.
   5. Red blood cells are examined and counted per area as seen through the small hole.
   6. Red blood cells will be found in approximately equal numbers, the number having no relation to the ethnic grouping.

C. Blood typing:
   1. Blood is drawn as above.
   2. Medium suspensions are made in physiological saline, one drop of blood to one cubic centimeter of saline.
   3. A slide is divided by a single vertical line and marked at the left "A" and on the right "B" with a marking crayon.
   4. At the far ends of the slide, a drop of the cell suspension is placed.
   5. On the left, a drop of O-typing anti-sera A is placed; on the right, a drop of anti-sera B.
   6. Mix each side with *opposite* ends of an applicator stick and allow to stand for six minutes.
   7. Agitate to overcome rouleaux-formation by tapping slide.
   8. Slides are examined for clumping; do not mistake specks of marking pencil for clumped cells.
   9. Clumping in A alone means type A.
      " " B " " " B.
      " " AB " " " AB.
      " "none " " " O.
   10. Each child may get his type in this demonstration; at the same time it has been shown that no particular ethnic group has a monopoly on any blood group.

D. Whole blood:
   To see the whole blood picture procedure, refer to *The Science Teacher,* February, 1955, pp. 41-44. Procedures are described and comparisons may be made as in sections A, B, and C. This activity demonstrates the continuity of the blood as a tissue.



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E. Whole blood:
   1. Whole blood and blood plasma may be secured from a local hospital.
   2. Observations are made concerning the difference between the two.
   3. The effect of oxalate on clotting may be discussed as well as the chemical and mechanical factors involved in clotting.
   4. The generalization of blood type and other blood factors, not race, being the important consideration in transfusions may be made.

F. Hemoglobin:
   1. Draw drop of blood by finger puncture.
   2. One drop of blood is added to one cc. of N/10 hydrochloric acid in a small test tube.
   3. Allow to stand for five minutes to bring out full color development.
   4. A brown color development indicates the release of hemoglobin.
   5. The Tallqvist Scale should not be used as it does not adequately demonstrate hemoglobin; furthermore, as a measuring device, it is inaccurate and crude; this may lead children to become anxious about a sub-normal determination which might be normal as shown by the use of a more accurate procedure.
   6. Degrees of color development can be compared to show that there is no relationship between the amount of hemoglobin and ethnic grouping.

G. Sickle cells:

   The racists' theory that sickle cell anemia occurs only in Negroes is argued in *Science*, November 25, 1949, as follows: "The hemoglobins of normal adult white and Negro individuals were found to be indistinguishable (hemoglobins are intrinsic factors in the sickle cells of anemic individuals)".[5] While most medical references to sickle cell anemia indicate that it is primarily a disease of the Negro race, reference is also made [6,7] to the fact that it occurs in Caucasians in fewer cases. However, the figures given are usually not comparative other than that one in forty Negroes has sickle cell anemia, while no figure is given for Caucasians.

H. Clotting time:
   1. Draw out pieces of glass tubing to produce fine capillary pipettes.
   2. Draw a drop of blood by finger puncture.
   3. Allow the blood to rise in a capillary pipette by touching the end to the drop of blood.
   4. Every half minute break a small piece from the pipette until a thread or clot is seen.
   5. Again, clotting time may be seen to have no relation to ethnic grouping.

II. Drawing Inferences

A. Identifying assumptions:
   1. Indiscernible differences in the blood of different groups do not exist.
   2. Slight variations in normal ranges are not remarkable.
   3. Large numbers of each group do not exhibit greater differences.

B. Making generalizations:
   1. Human blood is composed of cells and a liquid portion which perform the same functions in all people.
   2. Human blood may be transfused from one human to another regardless of ethnic grouping; all types are used for transfusions among and between races.
   3. Differences between members of the same ethnic group may be greater than differences between members of different ethnic groups.

C. Drawing conclusions:
   1. All elements observed in one blood sample appear in approximately equal numbers in all samples. ("So far as any blood experts can tell, there is not a whit of difference in the blood of healthy persons of any racial group or color.")[8]

While it is not expected that these activities will destroy the concept of race, it is hoped that attitudes towards racism and the accompanying ethnocentricity may be improved.[9] It is less scientific to deny racial differences between groups than it is to accept them while open-mindedly evaluating the individual, and scientifically gathering data concerning similarities and dissimilarities.

[5] Linus Pauling and Others, "Sickle Cell Anemia, A Molecular Disease," *Science*, CX (November 25, 1949), p. 544.

[6] *The Anemias*. Indianapolis: Eli Lilly and Company, Fourth Edition, p. 38.

[7] "Clinical Notes," *Seminar*, IX, No. 1 (February, 1947), p. 12. (published by Sharp and Dohme, Philadelphia).

[8] A. L. Blakeslee, "Blood's Magic for All," *Public Affairs Pamphlet*, No. 145 (November, 1948), p. 9.

[9] A useful publication is the monograph, *Combatting Prejudice Through Science Teaching*, by R. Will Burnett, published by the National Science Teachers Association. Price $1.00.

MAKING PROJECTS SERVE OUR INDIVIDUAL NEEDS*

By BROTHER I. ANSELM, F.S.C.

De LaSalle Institute, Chicago, Illinois

IT seems safe to say that science teachers today are quite familiar with the project method as a means of visual aid in teaching. Science teachers have long since come to understand that a project, in the broadest concept of the term, implies two phases. First, a project is the study of a proposed problem, or a series of related problems; and secondly, a project is a useful activity the purpose of which is to arrive at some definite objective. By means of projects, students can feel that here, perhaps better than in any other part of the course, is an excellent opportunity for lively imagination fired with healthy curiosity and supplemented with clarity of expression through the use of clever fingers. Moreover, projects demand that students make practical applications of principles often learned only in theory. Likewise, through this method of teaching, students are called upon to demonstrate graphically or to portray visually, thus providing the basis for the understanding and interpretation of the aspects of the technical knowledge they have gained. Projects, then, are challenges to youth and, therefore, should be used to full advantage for both the teacher and the students.

Projects should not be assigned at random. If *assignments* are made merely to keep students busy, or to supply material for an exhibit or a science fair, then I think we miss the real purpose of projects. On the other hand, if the projects are given for the betterment of the student, or to meet individual differences, or to help the special student to answer some definite need in our teaching or to emphasize some special point in the lesson, then they are worthwhile and should be encouraged. The point in question depends primarily on some specific need one has, or the particular objective one wishes to achieve.

The need for any particular project arises during the lesson itself when an illustration becomes necessary. This need becomes more pressing when some design or diagram on the chalkboard fails to convey the correct solution to the understanding of the principle studied. All of us can readily recall occasions in class when we were at a loss what to do, then looked around for something that would serve our immediate purpose, but found none. It was just such situations during my early years of teaching that started me on the general plan of making projects to suit my special needs. I went through catalogs or called on commercial firms for models, only to be disappointed that they did not carry such items in stock. Such visual aids have done much for me in solving my individual needs and therefore do have a place in my teaching.

A few demonstrations in the use of these models will further my method of handling them in a given situation. In former days I relied entirely on old familiar objects to illustrate different points. Thus three simple building blocks of a child helped me to explain the rather complex theory of elements and compounds, as well as their conversion from one substance to another. Again, a hard-boiled egg served to make clear the idea of the structure of a cell. The outer shell of the egg resembles the cell wall, the inner underlying membrane gives a good idea of the plasma membrane, while the white of the egg and the yolk represent the cytoplasm and nucleus. This proved somewhat helpful, but it did not answer the purpose adequately. Then I spoke to a boy about my plan for making a cell out of wood with the several parts so arranged that the model could be easily disassembled. The final result was the construction of a simple project that served my need most handily. Again, the matter of mitosis presents another difficulty for the student to master with only one or two laboratory exercises of microscopic observations. First the mitosis booklet, with which you are familiar, was used. This consists of a number of pages on which the different phases of mitosis are depicted. A mere flip of the pages brought out the sequence of the stages to the attention of the student. He has learned something, but the method is slow and cumbersome and only one student could view it at a time. Flash cards were tried with

* Presented in a "Here's How I Do It" session of the third NSTA national convention, March 26, 1955, Cincinnati, Ohio. In this article, "project" means essentially models for use as visual aids in teaching.

better results, but even these did not prove ideal. Then I found a discarded radio lamp. The paint on it was removed with sodium hydroxide. Two separate papers with the figures of mitosis drawn thereon were prepared—one to be placed inside the outer cylinder had a small window cut in it, while the other paper was fastened to an inner revolving drum. As the heat accelerated the inner drum, the figures of mitosis passed by the window. Boys found time in their work to watch this project as the drum went round and round. It was especially helpful to those who had difficulty in understanding the process. Thus the radio lamp did the trick nicely. Today this project is doing part of my teaching and perhaps does a better job than I could do with much elaborate technical explanation or discussion. This project is also used to illustrate the sequence of the stages in other studies; namely, the embryology of the chick and the frog, digestion and circulation in animals, and the life histories of insects and animals.

The ability to explain clearly the structure of a cross section of a nerve fiber, as viewed under the microscope, also gave me some trouble. The answer came with the use of a piece of telephone cable cut crosswise. The insulation on this cable was stripped back to expose the inner fine wires. These wires represented the several fine neurons composing the nerve fiber, with each neuron having its own insulation or white matter (medullary sheath). The core of the wire was a good illustration of the axon proper. This illustration gave one student the idea of fashioning something in wood in the form of a project and his finished work is still another model remaining in the laboratory.

The study of the cross section of the spinal cord was not producing the results I had expected. The work of a student gave me the solution to this problem. Today a model, with parts that can be disassembled and then reassembled, illustrates adequately the relationship of white matter to gray matter, as well as the position of the incoming sensory neurons to the outgoing motor neurons. Even the "hard-to-understand" association neurons, which must cross over to make the necessary and proper connections, are clearly depicted. This project has done much to help students grasp a clear idea of the structure and function of the spinal cord.

And who of us has not had difficulty in explaining the difference between the dicotyledonous and the monocotyledonous stems? Here four projects were constructed to make these ideas clear. First, two models were made to show the difference in their gross structure; and second, two others to show the relationship of their respective bundle arrangement. The two models of the gross structure are fixed, while those of the bundles have parts that can be disassembled and then reassembled as one explains point by point. This building-up type of model did much to make the ideas clear to the students in a very forceful manner.

There are any number of similar projects that are of daily use in our laboratory to illustrate ideas that are apparently hurdles for the students. A simple zipper explains the intricate structure of a feather and also shows what a bird does when it preens its feathers; the structure of a tooth in all its parts; the tracheal system in the grasshopper and other insects is clarified by two projects; the circulation in various animals by special models that can be taken apart and then rebuilt; the structure of a bud, both longitudinal and cross sections, are explained with a model; even the typical illustration of the fertilization in the flower. What has been mentioned is just a sample of what can be done. There seems to be no end to the possibilities of these models if we only adhere to this principle: if one does not have the particular model or project needed, then make it or see that it is made.

Of course there are many projects other than those that have been mentioned. These, too, should be made to meet your class needs. They are assigned only after careful teacher-pupil planning. High school students must be initiated into the methods of making collections, identifying the materials brought in, and preserving and storing them. Collections teach the student the first essentials of taxonomy which he will be called upon to use in college or in after-school days. To meet this situation guide sheets are issued in order to give the student the purpose and the necessary preliminary instructions so that he can work for himself. Experiments of different kinds—namely, what substances will or will not exhibit osmotic action and why there must be a digestive system—are also part of the program in order to give the fundamental training this type of project requires. These experiments can also be used immediately to supply the particular information the teacher needs for the lesson, and thus take much of the burden off his shoulders. Many of these experiments may fail in the first attempts but here is the opportunity to point out the reasons why, and to have the students correct the errors. Photography, X-ray identification with the help of a dentist or doctor, picture collection along definite theme topics, and making charts and lantern slides by those who are more gifted in the way of drawing are all routine procedures in the handling

of materials. These give the students those special techniques for solving future problems. Perhaps we even initiate practical research leading to the future discoverer or the inventive genius. The whole idea centers around the very simple plan of "do it yourself." Isn't it an educational axiom that "we learn to do by doing"?

To interest students in the making of models is not as difficult as one might be inclined to believe. I was skeptical when I started, but the students soon "caught on" and once they understood the point in question, they responded wonderfully. Today I experience little trouble having projects made. I think the answer to this question lies solely with the teacher himself. If one really wants a certain thing, he will take the means to get it. Some may simply order some of these projects or models from firms, if they can. I think there is a big loss here because the student does not become interested in this type of work, nor does he receive the training it gives. Usually one project follows another. Once the student sees what has been done, he can easily figure his own project accordingly. Today I simply ask the boys if such a model could be made, and the students take over.

Another motivation idea is to suggest that the students might like to leave something in the laboratory as they pass on to other courses at the end of their sophomore year. This has worked wonderfully. The students become highly interested and often surprise me with the things that come from their own thinking and fashioning. True, all attempts will not produce equal success, but it has possibilities for the newcomer. Place confidence in the abilities of your students and be ready to give whatever explanation or instruction that is required for the completion of the work. A second effort usually results in a fine finished project, for the old "trial and error method" still works. It is worth the try.

Foreign Teaching Posts. Positions in Army-operated schools in Germany, France, Japan, and Okinawa are available for the 1956-57 school year. For further information about qualifications, salary, and interviews, write to Overseas Affairs Division, Office of Assistant Chief of Staff, G-1, Personnel, Department of the Army, Washington 25, D. C.

Traveling Science Libraries for Small High Schools. The AAAS, in cooperation with the U. S. Office of Education and the National Science Foundation, has developed plans for this experimental program aimed at assisting high school students learn more about science and interesting some of them to become scientists. The libraries will reach six small high schools in ten geographic areas with the first unit of books scheduled to arrive in October. Dr. Hilary J. Deason is director of the program.

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A Study of the Nature and Extent of the

EMPLOYMENT OF LABORATORY ASSISTANTS

in the High Schools of the United States

By SAMUEL SCHENBERG

Supervisor of Science, High School Division, Board of Education, New York City

LABORATORY assistants are employed in colleges and universities, in various industries, and in research institutions. They are almost completely unknown in the high schools in the United States. And yet, more students are studying science in our secondary schools today than in our colleges and universities. With five or six crowded classes in two or more science areas, jammed into short periods, the secondary school science teacher finds it extremely difficult to prepare the necessary demonstrations and to set up the laboratory for student experimentation. A laboratory assistant can assume and carry out many of the non-teaching tasks which encroach upon the science teacher's classroom time and free him for his most important duty, *teaching*. Together they can form an education team similar to such well-known combinations as the physician and medical assistant, the dentist and dental mechanic, and the engineer and draftsman—just to mention a few.

The duties attached to the position of Laboratory Assistant in New York City were revised in the spring of 1952. They are:

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I. Duties in the departmental program of instruction and administration.
   1. Prepare, assemble, set up, and distribute apparatus, equipment, audio-visual aids, materials and reagents for the performance of:
      1.1 Teacher-demonstrations in science classes, and
      1.2 Individual and group experiments in the science laboratories.
   2. Be present in the laboratory, during laboratory periods, to keep set-ups in order, to replenish reagents, and to assist the teacher as needed.
   3. Take approved safety precautions in the transporation of all equipment and supplies to and from the science classrooms and laboratories.
   4. Prepare stencils and mimeograph material for the use of the department at the request of the chairman.
   5. Type official departmental reports at the request of the chairman.
   6. Assist in other ways for the welfare of the department as directed by the principal or by the chairman.

II. Duties maintaining and operating stockrooms, preparation rooms, and laboratories.
   1. Systematize the storage of apparatus, equipment, audio-visual aids, supplies, and chemicals in the science storerooms, preparation rooms, and laboratories so that they are easily accessible and readily found.
      1.1 Know the hazards involved in the storage of scientific equipment and chemicals.
      1.2 Employ approved safety standards and methods in such storage and in the use of supplies.
   2. Maintain the apparatus, equipment, audio-visual aids, supplies, chemicals, and live material in a usable condition.
      2.1 Make minor repairs.
   3. Construct simple pieces of apparatus as needed for the performance of demonstrations and experiments.
   4. Keep a live inventory of all science supplies and a "want-list" so that the needs of the department are known, and requisition equipment and supplies from the "S" and "G" lists as prescribed by the Divisions.
      4.1 Keep catalogues and supply lists on file and be familiar with their contents.
   5. Keep the contents of the stockrooms, storerooms, preparation rooms, and laboratories clean, in good repair, and ready for instant use.
   6. Receive and check the receipt of all science supplies as they arrive in school.
      6.1 Complete and return the necessary receipt forms to the vendors and/or Bureau of Supplies as prescribed by the Divisions.
   7. Arrange with the Bureau of Maintenance or by requisition for major repairs to science equipment.
   8. Take adequate precautions to safeguard all science supplies and equipment against breakage, spoilage, and theft.

9. Organize, instruct, direct, and supervise a science squad to assist him in carrying out his duties.
10. Never permit his stockrooms or preparation rooms to remain unsupervised if squad members are present.

III. Activities outside the scope of the laboratory assistant's functions.
1. Laboratory assistants are not to be assigned to take classes from which teachers are absent. Laboratory assistants are not teachers.
2. Laboratory assistants may not be asked to take building assignments.
3. Laboratory assistants may not correct Regents papers.
4. Laboratory assistants should not be asked to take charge of an audio-visual aids program which is conducted on a school-wide basis.
5. Laboratory assistants are not to be assigned to official classes or homerooms.

IV. The laboratory assistant's day is 7 hours exclusive of his time for lunch (Board of Education *By-Laws*, Article XII Section 91 Par. 4 (d)).[1]

All science teachers can readily appreciate the tremendous difference the presence of a laboratory assistant, performing the above duties, can make in a high school science department. Science chairmen in New York City feel that he is the key to a smooth-functioning science department. With him in the department student experimentation and teacher demonstrations are carried out on a vastly extended scale. Teacher research for new demonstrations and experiments is greatly facilitated. The morale of the science teacher is immeasurably heightened.

New York City created the position of laboratory assistant in 1900. A college degree was required until 1920 when the by-laws were amended to permit high school graduates to apply. In 1946 the by-laws were changed to the present qualifications which call for college graduation with 6 semester hours in approved professional courses and 18 semester hours in approved science courses. Appointment is based upon the passing of a series of examinations, including a written examination and a performance test. The salary has just been increased by $400 and will reach a range, from starting to maximum, of $3800 to $5300 in July 1956.

The present New York City budget provides for 162 laboratory assistant positions in the 54 academic high schools and 30 in the 31 vocational high schools. There has been a consistent yearly turnover of slightly more than 30% for the past 15 years. The three main reasons for this high rate are, (1) many laboratory assistants remain in their jobs only long enough to qualify for teaching positions which carry a maximum salary of $7600 (July 1956), and (2) others leave for industrial employment at higher salaries, and (3) the salary is too low to attract college graduates with the required qualifications. Because of these reasons it has become increasingly difficult to staff our schools with laboratory assistants. The difficulty has become even more acute since the shortage of science teachers has developed. Men and women with the qualifications demanded for laboratory assistants can find jobs easily outside of New York City. The last list of laboratory assistants, promulgated by the Board of Examiners on June 29, 1955, contained only 5 names. We have more than three times that number of unfilled vacancies.

An unfilled position for a laboratory assistant is of little use to a science department. The question of recruitment of laboratory assistants has been discussed by association of laboratory assistants, teachers, chairmen, and principals, as well as by the Board of Examiners and the Superintendents of the High School Division at headquarters. Four tentative sug-

[1] Combined circular—H. S. Division Circular No. 174, 1951-52; Voc. H. S. Division Circular No. 79, 1951-52—to the High School Principals, dated March 17, 1952.

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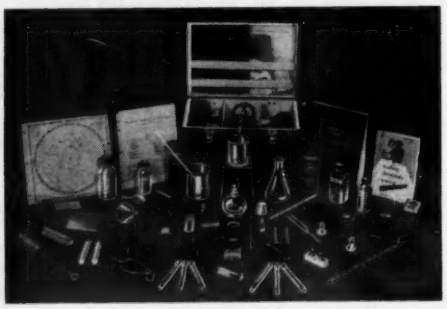

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gestions have been proposed as a result of these deliberations:

(1) Reduce the educational qualifications to high school graduation;

(2) Reduce the educational qualifications to high school graduation plus two years of college or junior college training;

(3) Accept those who qualify under (2) above as substitute laboratory assistants and give them 5 years to secure a bachelor's degree; and

(4) Continue present educational requirements and raise the laboratory assistant's salary to that of a teacher.

In order to obtain additional information concerning the employment, qualifications, duties, turnover, and recruitment of laboratory assistants, the writer was asked by Dr. C. Frederick Pertsch, Associate Superintendent in charge of the High School Division, to prepare and send a questionnaire and covering letter to superintendents of schools in other cities. The following questionnaire was sent to the superintendents in 11 cities on June 5, 1953 and also to the NSTA and the NEA.

Study of the Nature and Extent of the Employment of Laboratory Assistants in the High Schools

QUESTIONNAIRE

1. Do you employ laboratory assistants in the high schools? If the answer is "Yes", kindly continue with replies to the following questions. .....
2. How many laboratory assistants are employed? .....
3. What are the minimum qualifications for the position? .....
   .....
4. What are their duties? .....
5. What is their salary schedule? .....
6. How many hours do they spend on the job per day? .....
7. Have you a heavy turnover in the position? .....
8. Other comments, if any? .....
   .....

Superintendent preparing report: .....
Board of Education: City ..... State .....

Because the returns indicated that none of them included the position of laboratory assistant on their staffs, the writer decided to extend the survey to all cities in the United States having a population of 250,000 or more, to 8 cities with populations between 100,000 and 250,000 selected at random, and to two communities near New York City which were considered to be highly favored in an economic sense. Similar letters and questionnaires were then sent to 34 additional superintendents. The cities included in both surveys totaled 47 and included:

A. Cities with populations over 500,000 (17)—

Baltimore, Md.	Milwaukee, Wis.
Boston, Mass.	Minneapolis, Minn.
Buffalo, N. Y.	New Orleans, La.
Chicago, Ill.	Philadelphia, Pa.
Cleveland, Ohio	Pittsburgh, Pa.
Cincinnati, Ohio	San Francisco, Calif.
Detroit, Mich.	St. Louis, Mo.
Houston, Tex.	Washington, D. C.
Los Angeles, Calif.	

B. Cities with populations between 250,000 and 500,000 (20)—

Akron, Ohio	Memphis, Tenn.
Atlanta, Ga.	Newark, N. J.
Birmingham, Ala.	Oakland, Calif.
Columbus, Ohio	Portland, Oreg.
Dallas, Tex.	Rochester, N. Y.
Denver, Colo.	St. Paul, Minn.
Fort Worth, Tex.	San Antonio, Tex.
Indianapolis, Ind.	San Diego, Calif.
Jersey City, N. J.	Seattle, Wash.
Louisville, Ky.	Toledo, Ohio

C. Cities with populations between 100,000 and 250,000 (8) (selected at random)—

Des Moines, Iowa	Oklahoma City, Okla.
Hartford, Conn.	Omaha, Nebr.
Miami, Fla.	Providence, R. I.
New Haven, Conn.	Springfield, Mass.

D. Cities in the vicinity of New York City with high income groups—

Great Neck, N. Y.	Scarsdale, N. Y.

If New York City, NSTA, and NEA are added to the list, a total of 50 cities and associations were involved in this survey. The writer obtained 100 per cent cooperation as replies were received from all those to whom letters were sent. An analysis of the replies [2] indicates that:

1. *Only three cities in the United States, New York, Newark, and Baltimore, employ laboratory assistants on their high school staffs.*
2. *Four cities, Atlanta, Boston, Oakland, and San Francisco, make special provisions for using high school students to assist science teachers.*
3. *The other cities made no special provisions but indicated that science teachers were accustomed to seek and obtain assistance from their students on a purely voluntary basis.*

Replies from the cities named above follow:

ATLANTA, GA. Better students, after completing a year of chemistry and/or physics, are programmed for advanced chemistry

[2] Memorandum to Dr. C. Frederick Pertsch, Associate Superintendent, from Mr. Samuel Schenberg, Supervisor of Science, dated February 16, 1955.

3 or advanced physics 3. These students act as laboratory assistants and receive a half-unit of school credit toward graduation.

BOSTON, MASS. Employs 50 pupil laboratory assistants. These pupils are rated in the school by the principal and appointed in that school in order of excellence. They assist in the maintenance of the laboratory, perform clean-up duties, keep attendance records, and secure and set out materials for the teacher. They receive 60¢ an hour but may not work for more than 30 hours a month. They spend up to 5½ hours per day on the job.

OAKLAND, CALIF. SAN FRANCISCO, CALIF. Both employ bright students on a part-time basis and give them a token payment. The amount involved was not given.

BALTIMORE, MD. Employs high school graduates as laboratory assistants. They are paid between $2600 and $3600 for a 10-month period. They spend 6½ hours per day on the job. The reply continues, "We have not set up this position for permanency. Many of our assistants hold this job while training for teaching or to get money to go to college." Among the duties mentioned were ". . . helps pupils with laboratory work, quizzes pupils about work being done in the laboratory, assists in grading laboratory reports, checks safety factors involved in laboratory procedures, and two days a week, either before or after school, assists teachers in make-up laboratory periods."

NEWARK, N. J. Newark employs laboratory assistants on the basis of competitive examinations conducted by a Board of Examiners similar to the procedure employed in New York City. These men and women have college degrees and are certified by Newark or the State of New Jersey. If certified by Newark they receive a beginning salary of $3400 and progress in seven steps to a maximum of $5300. If certified by New Jersey the range is $3300 to $5100. Newark also employs some laboratory assistants without certifications. These men and women are employed on a salary range between $3300 and $4700. The duties of the laboratory assistant were summarized as "to work with the regular science teachers, setup apparatus, check papers, take care of equipment, and assist teachers." The reply claimed that they had no difficulty staffing their schools with laboratory assistants.

Because Newark is only a one-hour trip from New York City, the writer asked and received permission to visit the Weequahic High School. Dr. Michael McGreal, Assistant Superintendent, was good enough to accompany the writer. The principal, Mr. Conovitz made us very welcome. We visited the three laboratory assistants in that school on the job. The chemistry and physics laboratory assistants assume complete charge of their respective laboratories. They not only supervise the performance of all student laboratory experiments but also encourage students to work on individual projects. In addition each science student registers with the laboratory assistant and is assigned on the basis of free periods and not necessarily by subject class. Integration of laboratory work with classwork is not always possible.

About six months ago the High School Division, after many conferences with members of the laboratory assistants' association, has recommended to Dr. William Jansen, Superintendent of Schools, suggestion (3) as stated above. The maximum annual salary of the laboratory assistant would be pegged at $1000 below that of a teacher. No action has been taken on this suggestion at the present time.

The NSTA can bolster secondary school science teaching by considering the advisability of advocating the introduction of the position of laboratory assistant in all high schools employing four or more science teachers. A committee of the NSTA might investigate the educational qualifications, duties, hours, and salary that it would recommend for laboratory assistants. The writer is of the opinion that the laboratory assistant, as an expert technician, can raise the standard of science teaching, increase the efficiency of the science teacher, will raise his morale, will improve the number and quality of teacher demonstrations and pupil experimentation, can assist and encourage individual student projects, can provide job opportunities for capable students who will not, at least in the beginning, enter college for a degree, and finally will assist in the recruitment of science teachers. Many additional benefits will surely occur to the reader.

PSYCHOLOGY AS A HIGH SCHOOL SCIENCE

By T. L. ENGLE
Indiana University, Fort Wayne Center

THERE is evidence that psychology is emerging as a recognized area of instruction in high schools. Most frequently it is taught in a Social Studies department, but in some high schools it is taught in the Science department. Certainly this scientific orientation is in line with psychology as it is taught in universities and with the kind of psychology stressed by the American Psychological Association.

As a member of two committees of the Association, the writer has made a number of questionnaire studies of high school psychology, has visited the classes of 31 teachers in eight states, and has reviewed the literature in the field. High school science teachers, whether or not they teach psychology, will be interested in this new science which is knocking at their door.

Present Status of High School Psychology

Surveys indicate that psychologly is taught as a separate subject of instruction in some high schools in at least 34 states, probably in all of them. Between 1933-34 and 1948-50 the per cent of enrollments in psychology courses more than doubled. Several states have psychology courses offered in from twenty to twenty-five per cent of their high schools and with from two to five per cent of their high school population in such courses. Other states have only a few high schools offering psychology.

It is principally in the larger high schools that psychology is offered as a separate subject of instruction, but psychology courses are frequently found in surprisingly small high schools. In about two-thirds of the high schools psychology is a one-semester course, in the other third a two-semester course. Of 436 teachers answering a questionnaire, 78 (17.9 per cent) indicated that psychology is a required course in their schools, 358 (82.1 per cent) said it is an elective.

Teachers and principals tend to think of psychology as a terminal course designed to help students in their personal and social adjustments rather than a preparation for more advanced study in the field.

The Students Taking Psychology

In many high schools some work of a psychological nature is offered in connection with freshman orientation programs, but as a formal course psychology is usually offered in the senior year or in the junior and senior years combined. Somewhat more girls than boys take psychology and this newcomer to the field of high school science may offer a solution to the problem of girls who do not wish to take physics or chemistry. There seems to be a tendency for students planning to become teachers to take psychology in high school.

Some principals restrict the number of classes offered so that psychology will not become a dumping ground for poor students. In some schools it is said that students with emotional problems of adjustment tend to take psychology in the hopes of finding help for their problems. In other schools it is said that such students carefully avoid the course in psychology. Some teachers and principals say that those students taking psychology are the ones who plan to go to college. For example, in one high school approximately 15 per cent of all seniors go to college but approximately 40 per cent of seniors taking psychology go to college. Sometimes superior seniors take psychology as a fifth subject although they may not need the credit for graduation. On the other hand, some students with a failure or two along the line may take psychology in order to make up a needed credit or two for graduation. Probably the students taking psychology represent a pretty normal distribution of upper classmen.

The Teachers of Psychology

Although there are some, relatively few teachers devote full-time to the teaching of psychology. In addition to their teaching of psychology, teachers are especially likely to teach social studies and, to a lesser extent, science and mathematics. More men than women teach psychology. Approximately a third of the men are serving as principals or superintendents. In some schools, the director of guidance teaches the psychology course. There is a tendency for psychology to be taught by the more experienced teachers, especially in the case of women.

Teachers of psychology are well trained in terms of years of college preparation, one study indicating a mean of 5.04 years. They seem to be trained primarily in social sciences and education with,

however, considerable training in psychology and some training in other sciences. For example, a questionnaire returned by 127 teachers revealed that the mean number of semester hours training in psychology and educational psychology was 18.49. For these same teachers the mean numbers of semester hours training in areas related to psychology were as follows: social sciences 27.14, education (other than educational psychology) 24.64, biological sciences 10.30, mathematics 8.99, physical sciences 7.78.

Teachers often report that they find more enjoyment and satisfaction in teaching psychology than in teaching any other subject, although it is more difficult to teach than some of the traditional subjects.

Experimental Foundations for High School Psychology

Especially since World War II, psychology has enjoyed an unprecedented popularity with adults as well as with students. All too often it is considered as an almost mysterious study of the "mind" without experimental foundations. For the many high school students who do not go to college, and for those who do go to college but do not take psychology there, the high school course is their only formal contact with the subject. Will they be fortified against popular misconceptions of psychology? Will they learn to read with a critical and evaluative attitude "psychological" articles appearing in newspapers and popular magazines? Will they be able to distinguish between pseudo-phychology and scientific psychology based on experimental foundations?

High school teachers of psychology meeting in a workshop at Teachers College, Columbia University, in 1952 "agreed that laboratory experiments may be very instructive in connection with the teaching of certain psychological principles" and added that "the more involved students are in the experiments, the more effective they tend to be."

At the present time, very few high schools provide a formal laboratory period for the psychology course. A questionnaire survey has indicated that only three per cent of the teachers responding conducted formal laboratory periods. However, of 217 teachers in 34 states, 35 per cent said that they had some experiments performed by all members of their classes and 40 per cent indicated that they performed experiments as demonstrations. Some teachers reported that they conducted the experiments outlined in the workbook which they were using, but only 13 per cent of them used a workbook. It is of interest to note that in another survey of 135

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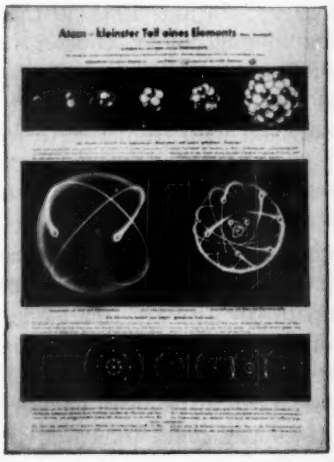

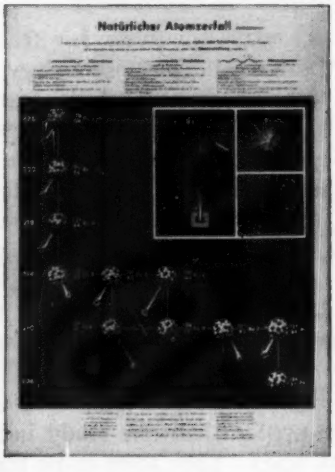

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teachers, 58 per cent said that they would like to have for student use a manual emphasizing projects and experiments and an additional 14 per cent thought that they might wish to use such a manual. Many of the "experiments" listed by teachers would scarcely fall under that heading in a university laboratory course, but they did indicate the use of such experiments as the following: learning of mazes and puzzles, code learning, retention of nonsense and other material, reaction time, conditioned response learning, color mixing, testing for color blindness, optical illusions, cutaneous sensitivity, perception of time intervals, attempts at telepathy. One teacher reported effective use of the demonstrations suggested by Norma V. Scheidemann in her book, *Lecture Demonstrations for General Psychology,* University of Chicago Press, 1939.

Probably many teachers would like to introduce laboratory work but feel that they lack the necessary equipment. Some have reported borrowing equipment from biology and physics departments, but others have reported having students make their own apparatus, for example, wooden mazes for use in learning experiments. B. R. Bugelski suggests how to make simple and cheap, but effective, apparatus in his book, *A First Course in Experimental Psychology,* Henry Holt, 1951. Many experiments in psychology can be performed with only paper-and-pencil "apparatus." Most students who have been interviewed have been very enthusiastic about experimental work as part of their psychology course.

In psychology many experiments can be performed without a formal laboratory. Of the 217 teachers mentioned previously, 26 per cent had students conduct surveys in the school and in the community and then analyze the data. Surveys mentioned included: time spent in watching TV, student study habits, the extent of smoking and drinking by students, student use of leisure time, eating practices in the school cafeteria, evaluation of the psychology course by present and former students, practices in boy-girl relationships (for example, petting and going steady), the extent of the use of comic books by children, the use of liquid soaps by housewives.

Psychological tests were administered to their classes by 60 per cent of the teachers and 49 per cent of them explained or demonstrated such tests in place of or in addition to administering them. Tests administered included various groups tests of intelligence, personality inventories, aptitude tests, vocational interest inventories, and standardized achievement tests. Teachers demonstrated or explained such measuring devices as individual intelligence tests and projective techniques. Some teachers have their students score standardized tests administered in the elementary schools of their cities and then discuss the data so obtained.

High school textbooks in psychology tend to stress problems of mental hygiene, personality, and interpersonal relations. An analysis of these books has indicated that only 14.5 per cent of the space in them is devoted to experiments, techniques, and measurements. Mathematics is at the foundation of any science and certainly statistics and statistical procedures are stressed in modern American psychology. However, high school textbooks devote only 1.5 per cent of their space to statistical concepts and techniques, probably because so many students and some teachers fear anything called mathematics. In a recent survey of 135 teachers, 15 per cent indicated that they wished to have all material on the statistical meaning of correlation deleted from the textbooks and another 47 per cent thought such material should only be in the appendix of a book. If psychology is to be a high school science, complete with laboratory work, can the mathematical foundation be ignored?

Making Professional Contacts

Teachers of psychology are a minority group. As such they have some special professional problems. At present the American Psychological Association has no class of membership open to most high school teachers so the teachers do not have opportunities for personal contacts with leading psychologists, nor do they receive the journals of the Association. Perhaps teachers will have their best opportunities for contacts with psychologists through some kind of affiliation with their state or city psychological associations, but apparently very little, if anything, has been done toward establishing such relationships. An attempt has been made to form a national association of high school teachers of psychology but apparently the project has been dropped. The psychology teachers in at least one state (Indiana) are working on a state organization.

High school teachers of psychology are without a professional journal of their own. Such a journal would enable them to exchange ideas on methods and techniques used in teaching psychology and could serve as an outlet for reports on research being conducted by them. For the present, teachers of psychology could assist each other by publishing articles on high school psychology in some of the journals already devoted to problems of secondary education.

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Harvard Graduate School of Education, Cambridge, Massachusetts

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(Please continue on page 244)

A TEST FOR SPEED AND UNDERSTANDING OF SCIENCE READING MATERIALS*

By CLIFFORD R. NELSON

Weeks Junior High School, Newton Centre, Massachusetts

THE CONSCIENTIOUS SCIENCE TEACHER is concerned with as many of the children's problems as conditions will allow. We, who teach general science, know that there are many impediments to the kind of progress we would like to have children make. One of the basic difficulties is rooted in the wide range of reading abilities of the individuals. We make many attempts to overcome this by providing graded reading materials, using visual aids, and other devices. My concern, however, is to try to get the child to do something about his reading ability by calling his attention to a few things particularly pertinent to general science.

It has been interesting to note that high scores on standard reading tests do not always indicate a similarly high ability to read science material. That there is a different approach to each kind of reading material comes as a surprise to many pupils.

It is my purpose to illustrate and describe one of a series of similar tests which I use in my regular science classes. It is designed to test a pupil's ability to read science materials with speed and understanding. This device is helpful to the teacher in that it helps him understand his pupils better. It gives information to the pupil about a part of his reading ability. Boys and girls generally welcome this opportunity to find out a little more about themselves and are most cooperative. Their interests center about three areas: (1) What is my reading ability compared to the rest of my group? (2) What are my weaknesses as a reader of science material? (3) What can I do to overcome these weaknesses?

The test is so constructed that it gives two scores. One score is based on the combination of the speed with which a pupil reads in relation to the accuracy he achieves. The other score is accuracy alone.

The reading material consists of a few paragraphs of science reading matter which is selected, insofar as possible, to be unfamiliar to the student. The content is factually true and generally accepted. As this is a reading test, we are not concerned with what the pupil now knows; we are concerned with what he can get from the reading he does while taking the test.

An attempt has been made to organize the material so that it becomes increasingly difficult. The first statements are simple and factual. As the reader progresses, he finds the statements becoming more involved both in structure and in content. This type of organization provides opportunity for every pupil to get some correct responses, but makes it difficult for any pupil to get all of the test questions correct. This organization is also helpful in recapitulation, for the pupil can determine when, why, and how he failed to interpret questions correctly.

The reading material is followed by a test covering the reading content. There are fifteen statements in this particular test. Some are true, some false, and some questionable. The pupil is instructed to consider the reading material as the sole authority for the answer which he chooses. Therefore, if he can find no clear-cut statement which justifies him in saying a statement is true or false, he can mark it questionable.

The test is timed and the total time includes the time required to read as well as the time used to complete the test. The time is noted by the pupil as indicated in the administration procedure.

1. The pupils are told of the two-fold purpose of the activity.
   a. To enable the teacher to be more helpful to each pupil.
   b. To enable the pupil to find out something about himself as a reader of science literature.
2. The pupils are told they will be timed in the following manner.
   a. The teacher will tell them to begin.
   b. At the end of four minutes the teacher will announce, *"Four Minutes."*
   c. The teacher will then indicate ten-second intervals by writing 10, 20, 30 on the board.
   d. At the end of each *minute,* the teacher will announce what minute has been reached. He will then continue to record the ten-second intervals for the next minute.

* Presented at a "Here's How I Do It" session of the second NSTA national convention, April 3, 1954, Chicago, Illinois. For a copy of the reading test, please write directly to the author.

e. The pupils will record the number of minutes and seconds required to read *and* complete the testing in the spaces provided at the top of the test.
f. When a pupil finishes, he will turn to some quiet activity and wait for the group to finish.
g. The teacher will continue the above timing procedure until all have finished.

3. The pupils are told that they are to read the material without looking at the test sheet. To facilitate this, the material is passed out with the reading matter over the test sheet so that they will come to the test itself after they finish the reading. When they come to the test, however, *they may refer to the reading material* as much as they wish. This gives them the opportunity to satisfy themselves that they have justified their choice of response.
4. The pupils are told that they are to consider the material they read as being the sole authority for their choice of response to the test item. They are not to rely on what they know or on what impressions they may have.
5. The teacher then considers any problems the children raise.
6. They are told to begin.

After the testing is completed, the scoring must be done. It is desirable to have the children exchange papers and score someone else's test.

Each test item is considered in detail. The children are asked to raise their hands if they know the correct answer to the first problem *and* if they can support it by an excerpt from the reading material. When a youngster is called upon, he is expected to tell the class where, in the reading material, he found support for his answer. He then reads it aloud to the class. If there is disagreement on the correctness of his answer, discussion takes place until there is agreement. This helps the pupils see what kind of errors they may have made.

The total number marked right is recorded in the space provided at the top of the test sheet. The test paper is then turned over so that the back may be used for a computation sheet. The computations are simple and are as follows:

1. Change the time from minutes and seconds to seconds.
2. Divide the total number of seconds by the number of correct answers. The quotient is called the score and is arbitrarily stated as the number of seconds it took to get one right answer.

The teacher makes a distribution of the computed scores and divides them into four equal groups. One-fourth of the pupils, those having the lowest scores, are called reading group I. The other groups then become II, III, and IV. Group I pupils are the fastest readers.

A distribution is also made of the number of test items correct. This distribution is also divided into four groups. The best scores are in the first group and are labelled with the Arabic 1. The other three groups are designated 2, 3, and 4.

The teacher records both groupings for each pupil in his own records and on the test sheet which is returned to the child. A typical designation may be I/2 or IV/3. When the papers have been returned to the pupils the rating designation is explained. The Roman numeral indicates the group to which they belong on the basis of combined accuracy and speed, while the Arabic number indicates their group on the basis of accuracy alone.

The pupils are quick to note that there are four kinds of readers identified.

A—The fast, accurate reader.
B—The fast, but inaccurate reader.
C—The slow, accurate reader.
D—The slow *and* inaccurate reader.

It takes little direction from the teacher for the group to offer sound advice to each kind of reader. Members of group A are told not to rest on their laurels but to try to increase their speed without loss of accuracy. People in group B are told to slow down a bit in order to improve accuracy. People in group C should find ways to increase speed. Group D people get the sympathy and the encouragement of the class. They are told to be concerned with accurate reading first and that speed might be developed later.

Many pupils are not content to know their relative positions. They want to know if something can be done about their own particular problems. Three courses of action have been followed. Direct help has been given where possible. Pupils have been directed to their English teachers for help that they could give. Pupils have been referred to the city reading consultants for special help.

Reading is a skill basic to the success of any pupil in science. If our boys and girls have difficulty with science, the above test can be of assistance to the teacher who feels a responsibility for more than mere subject matter.

HAVIGHURST—continued from page 224

relations. . . . I think we can say, even in the face of current fears and pessimism, that during the ups and downs of the past million years man has gradually acquired more understanding, more freedom from fear, more dignity, greater kindness, and a clearer conception of justice. . . . Slowly but surely the understanding of man provided by science will help to make our life more intelligent, toil more cheerful, fear and hatred, pain and tears less prevalent in our life."

And he is seconded by Harrison Brown, speaking toward the beginning of a distinguished career in science, who says,[4] "It is clear that, if man wills it, a world community can be created in which human beings can live comfortably and in peace with each other. But that achievement will require application of intelligence, courage, planning, and prodigious effort. And it is equally clear that the time for decision is now—our survival depends on the victory of wisdom and knowledge over stupidity and dogma."

We are faced today with a wide-spread loss of faith in man's reason, and therefore in science, which is the tool of reason. There are many people who fear that the civilization of the West is declining and that the only solution is to turn back to the eighteenth century and to try to recapture the conservative political and social features of that age. These people mistrust reason and they call instead for a return to traditions of an earlier day.

But I believe that our only hope for a better future lies in the use of our reason, with the fullest possible support of science in all areas of life. The hope of the future lies in reason, work, and brotherhood. Science teaching should aim at making people better reasoners, better workers, and better brothers.

[4] Harrison Brown, *The Challenge of Man's Future*. pp. 265-66. New York: Viking Press, 1954.

Cancer Information Institute. On October 15, the National Cancer Institute, in cooperation with NSTA and the U. S. Office of Education, will conduct a one-day Cancer Information Institute for high school teachers of science subjects. The purpose of the Institute is to provide: (1) helpful suggestions for demonstrations, projects, and experiments on the secondary level which may be introduced at strategic points of school courses of study as they may relate to cancer; and (2) incentive and motivation for further arousing student interest in research problems with a view to stimulating the desire for professional careers in science and research. For details about the program for the Institute, write to Dr. I. Light, Cancer Reports Section, NCI, Bethesda 14, Md.

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WHAT "IT" DID FOR NANCY

By LELAND L. WILSON

Iowa State Teachers College, Cedar Falls

What is "it"?

"It" is the program of Science Achievement Awards for Students conducted by the Future Scientists of America Foundation of the National Science Teachers Association, with financial support by the American Society for Metals. The program is now in the fifth year. For three successive years "it" has done things for Nancy.

Who is Nancy?

Nancy is now a young lady of sixteen who finished the tenth grade this year. She is interested in boys, movies, music, and science. Her first science project was carried out three years ago in the eighth grade under "its" stimulus. Similar projects were completed in the ninth and tenth grades.

What did "it" do?

First, "it" developed a casual scientific interest into a sustained interest which found expression in a variety of activities. Nancy's interest in science when she entered the eighth grade was about the same as that of any normal thirteen year-old. When she learned of the Future Scientists program her interest quickened. She selected a project involving the study of bacteria, which led to wider reading, interviews with specialists, and much experimenting.

Thus, "it" gave actual contact with professional scientists and led to a tentative choice of a life-work. Nancy's first elementary project on bacteria has been followed by two others of increasing complexity. These projects necessitated contact with specialists in biology and medicine, who were always helpful when they realized that the young lady was serious. These contacts led to the opportunity to work in a hospital laboratory and the interest grew into a vision of a profession in bacteriology or medicine.

What would happen to our desperate shortage of scientific manpower if all our young people could have such an opportunity? Certainly a much larger proportion of those with talents for science would enter scientific vocations. The studies of Herbert S. Zim and others have shown that interests leading to scientific vocations develop at an early age, and it seems imperative that we cultivate such interests.

Then, "it" gave opportunity for original work, and thus developed self-confidence. Nancy "grew up" rapidly in these three years. It is certain that much of our science teaching is inadequate in challenging students to original thinking. Not so with a serious student science project! The major challenge here is in original ideas and this leads naturally to more self-confidence. Nancy's science projects not only gave her the satisfaction of working out some of her own ideas in the laboratory, but also developed self-confidence which was reflected in other activities, including all her school classwork.

Anna Roe has studied extensively the personal characteristics of eminent American scientists. She found that one of the most important factors in the decision to become a scientist was the discovery of satisfaction in doing simple research. All young people who are capable of scientific work should be allowed to make this discovery early.

Furthermore, "it" gave recognition for serious study and achievement in science. All of us like to have others acknowledge our importance. Young people need recognition, perhaps even more than adults, and this need exists in areas other than athletics, the general public attitude notwithstanding. To be recognized by national organizations such as NSTA and the American Society for Metals —as Nancy was—will be a thrill for any student. The Future Scientists of America Foundation has very wisely planned for the distribution of awards throughout the country. The division of the nation into regions and judging on a regional basis assures that each student's work will be compared with that of other students from somewhat similar schools.

In addition, "it" created a recognition of the value of clear, concise writing. Much of the writing which students do in school is quite artificial, since they are not really trying to convey their own ideas or describe their own experiences. Paragraphs may be expanded merely to reach the required number of words. Not so in writing a report on an FSAF project! The student is limited as to the length of the paper, and must learn to make words count. Nancy also realized that clarity of expression would have much influence on the

decision of the judges. This knowledge stimulated revision and rewriting, which is excellent training for any student.

Finally, "it" provided worthwhile activity for leisure time. We are increasingly concerned about the leisure activities of our teenagers. The Foundation's program certainly has much to offer in this respect. Nancy walked many times after school to the library, hospital laboratory, or college biology laboratory instead of joining the "gang" or just loafing. As the interest in each project grew, time became a self-rationed commodity instead of a surplus one.

How do I know what "it" did for Nancy?

I am Nancy's father; she is the oldest of three daughters. The fact that I am also a science teacher is incidental in this matter. I am not greatly concerned as to whether any of my children choose scientific vocations, but I am vitally interested in the fullest development of whatever capacities they may have. Therefore, I am deeply grateful to those who have made this program of the Future Scientists of America possible, and I covet "its" opportunities for all other youngsters as well as for my own.

LISTON and WOODSUM—

continued from page 239

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Classroom Ideas

General Science

Something New to Show the Change of Seasons

By VERNA SHIELDS and A. E. CLYDE, Students, Pennsylvania State University, University Park

Equipment

⅜" x 3' x 2' Plywood
4 Red and Blue Rubber Balls
4 Knitting Needles
Pasteboard 1" x 7"
½" Mesh Hardware Cloth 6" x 10"
¼" Fibre Board
Protractor
Light bulb, socket, and cord

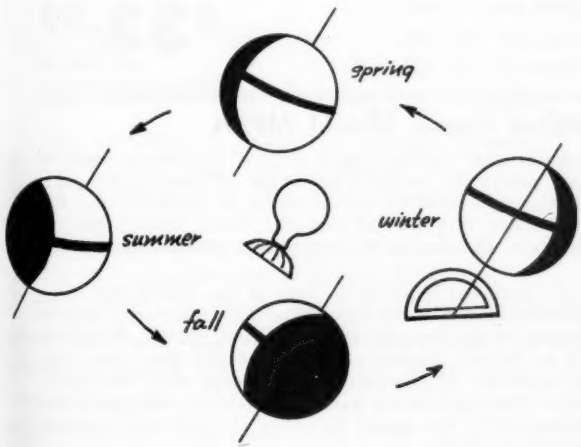

Figure 1

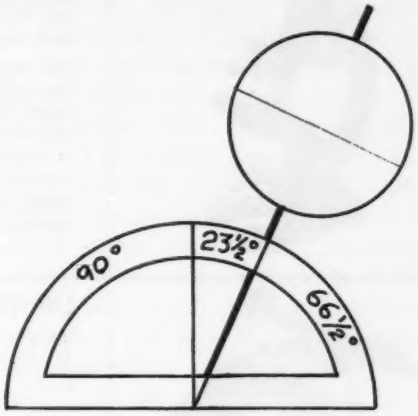

Figure 2

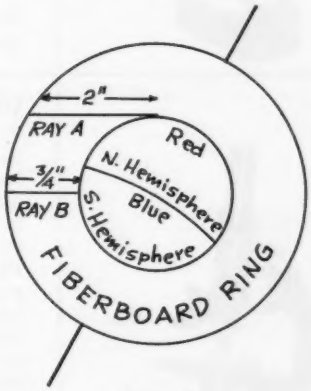

Figure 3

Distance traveled by Ray A through the atmosphere is over twice that of Ray B.

Instructions

The equipment is assembled on the plywood base in the conventional manner as shown in Fig. 1. A protractor is added as shown in Fig. 2 which helps to explain the expression, "the inclination of the earth's axis to the plane of its orbit."

From the fibre board a circular piece 1½" greater in diameter than that of one of the balls is cut. A hole is cut in the center of the fibre board slightly smaller than the ball. The ball is then inserted into this hole. This is shown in Fig. 3 as representing the earth's atmosphere, and shows that rays from

(Please continue on page 247)

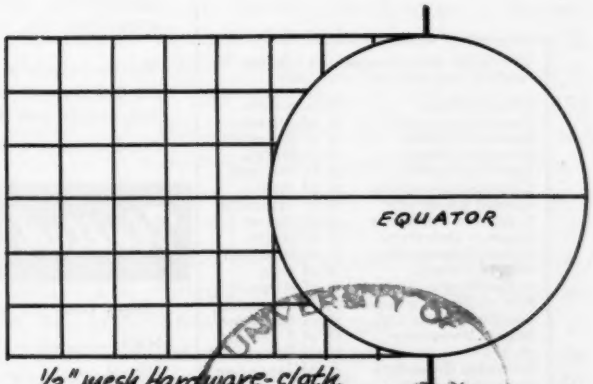

Figure 4

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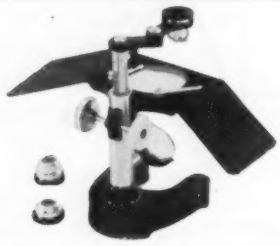

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the sun must travel varying distances depending upon the earth's inclination.

The varying slant of the sun's rays is shown by using a piece of ½" mesh hardware cloth cut to the shape of the ball (Fig.4). We allow each ½" to represent a ray of light. This shows the amount of surface each ray would have to heat or light.

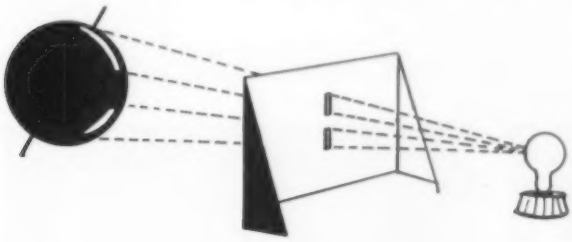


Figure 5

This same effect can be illustrated by using the pasteboard as shown in Fig. 5. It is to be noted that the slots are of equal length in the pasteboard, but the areas covered by the two different light beams are unequal in size.

Elementary

An Interesting Surveying Project

By GEORGE S. BARR, Elementary Science Coordinator for Brooklyn
New York City Public Schools

Here is a simple surveying exercise which children find very enjoyable and educational.

Somewhere in your immediate neighborhood there are surveyors' reference points which give the elevation above sea level. Such little blocks of concrete or brass are called "Bench Marks" or "Monuments." In New York City the Bureau of Topography keeps a record of these.

The surveying job the children can do is to find out how high above sea level is the teacher's desk. They place an engraved plaque on it when they are through:

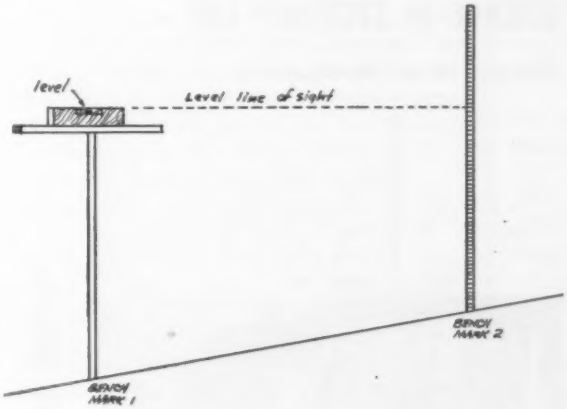
THE ELEVATION OF
THIS DESK IS
93.4 FEET ABOVE SEA LEVEL
DETERMINED BY CLASS 6^2
OCTOBER, 1954.

A carpenter's level is used. It rests upon a platform nailed to an old broom stick. For each calculation the combined size of pole and level should be 4 feet. This keeps the arithmetic simple.

The rod is a pole about 6 feet long, marked off in inches starting at the bottom.

The crew consists of 3 students. One sees that the bubble in the level is always in the center. The other sights along the top so that the front edge of the level coincides with the back edge. By means of 3 signals he tells the rodman where to place his index finger—Right arm up means higher; right arm down means lower; both arms flapping like a bird means stop. The rodman now measures the height of his finger from the ground. This distance is subtracted from the elevation of the level line to get the elevation of the spot the rod is resting upon.

For example—suppose the elevation of the Bench Mark 1 is 24.00 feet and the height of the pole and level is 4 feet. The level line of sight now is 28 feet above sea level. The ruled off rod is sighted at 2 feet. The new Bench March 2 is therefore 26 feet.



Now the level and pole are placed on Bench Mark 2 and the rod moved further to determine Bench Mark 3. In this way the elevation is brought right up to the school building and marked with chalk. A weighted string is lowered from the class room window and the distance determined and added to the elevation. From the window sill to the desk there is a distance that must be subtracted.

The entire exercise is done about 5 times and averaged to rule out bad errors.

The plaque can also be placed on the wardrobe door. The students donate about 5 cents each for a real professional engraving job.

Don't let the arithmetic scare you. The writer has done this work with many classes in the fifth and sixth grades.

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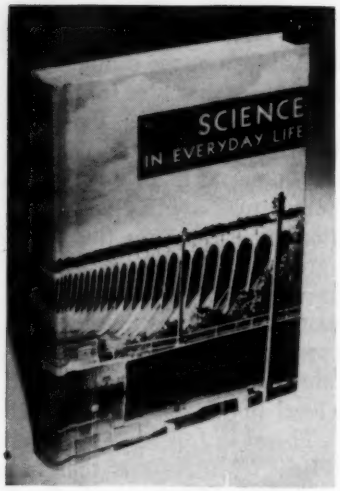

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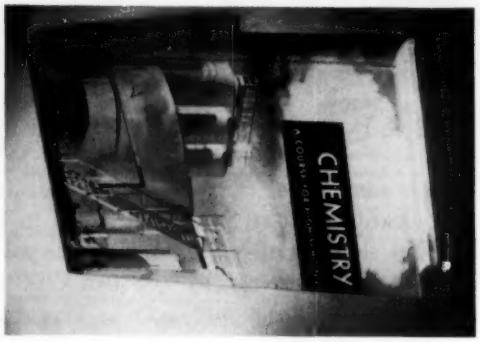

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NSTA Activities

NSTA Midwinter Regional Meeting

NSTA this year resumes the custom of a cooperative meeting with the American Nature Study Society and the National Association of Biology Teachers at its regional meeting in Atlanta, December 27-30, 1955, which is being held in conjunction with the annual meeting of the American Association for the Advancement of Science. In addition to three jointly-planned sessions, each organization will have individual meetings geared to the special interests of its membership.

On Tuesday and Thursday afternoons, one NSTA session is planned for secondary schools and two concurrent sessions for elementary schools. The high school program on Tuesday, entitled "Attracting Secondary Students into Science," will feature five demonstration-lectures in the physical sciences by outstanding scientists and educators. Thursday, a "Here's How I Do It" program ("Arriving at a Grade in Multiple Ways") will center on the theme of evaluation. A panel of science educators will present four classroom activities—a film, an experiment, a lecture, and a student project—and then demonstrate how he evaluates the learning experience. That afternoon is planned to give opportunity for audience participation. A presentation of a new test in science, prepared by the Educational Testing Service, will be an outstanding feature of the program.

Elementary teachers will have the opportunity of hearing leaders in the field of education discuss, "How Can We Develop Continuity in the Elementary Science Program So As To Eliminate Repetitions and Gaps?" A practical session, "The Effective Use of Science Demonstrations for Improved Learning at Different Grade Levels," including such titles as "Water Appears and Disappears" and "What Makes Toys Work?" is in store for Thursday afternoon in the elementary sessions.

In keeping with the AAAS theme, joint meetings of the three teaching societies are emphasizing progress in agriculture, medicine, and research in the past fifty years. The NSTA-planned joint session is scheduled for Tuesday evening, December 27. The featured speaker will speak on "New Frontiers in Research." Following this meeting, the Atlanta Science Teachers Club will take over with a program of entertainment in a lighter vein. The session planned by ANSS on "Agriculture" will be held on Tuesday morning. NABT is responsible for the Wednesday morning joint-session with a program on advances in medicine.

NSTA will co-sponsor the National Association for Research in Science Teaching symposium on "Applications and Implications of Research in Science Teaching" on Wednesday afternoon, December 28. NSTA will also participate in the general meeting of the AAAS on Thursday morning, at which a figure of national importance will speak on the emergency in science teaching.

Further program details of time and place of meetings, as well as names of speakers, will appear in the November issue of *The Science Teacher*.

Washington Convention, 1956

Your planning committee reports excellent progress on the program for the Fourth National Convention of NSTA. Local and national committees are hard at work planning for you the best convention ever.

The place—Washington, D. C.! Headquarters hotel—The Shoreham! The dates—March 14-17! The theme—"Problem Solving—How We Learn!"

Nationally known scientists and leaders are being secured to serve as speakers for general sessions and as coordinators of work-discussion groups. Key personnel from all areas of science are being invited to act as resource consultants. Programs of special interest to teachers of primary and intermediate grades, junior high school, high schools, and colleges are being arranged. Research centers and elementary schools in and around Washington are planning the most effective ways for you to observe science-in-the-making, PROBLEM SOLVING *in action*. Science teaching films, the Exposition of Science Teaching Aids, the annual banquet, and Washington hospitality night will round out the program.

The entire program is being planned to give you practical helps for use in your own teaching situations. DON'T MISS this unusual opportunity to add to your professional growth, this opportunity to give your teaching morale a boost! PLAN NOW to join your colleagues at the 1956 meeting. LET US KNOW if you wish to volunteer for a share of responsibility in the program.

The Committee

Henry A. Shannon, *chairman;* State Department of Public Instruction, Raleigh, North Carolina.

Hubert N. Alyea; Princeton University, Princeton, New Jersey.

SCHOOL WEATHER STATION EQUIPMENT

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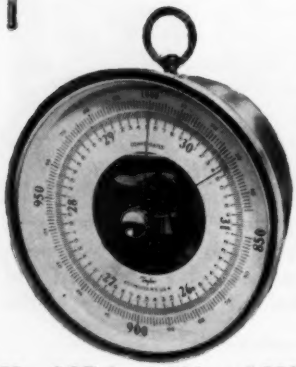

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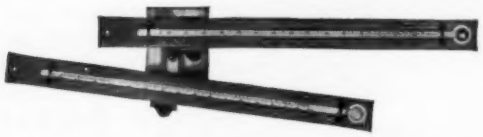

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Glenn O. Blough; University of Maryland, College Park, Maryland.

Robert H. Carleton; NSTA Executive Secretary, Washington, D. C.

Ruth E. Cornell; Public Schools, Wilmington, Delaware.

Hubert M. Evans; Teachers College, Columbia University, New York, New York.

Thelma C. Heatwole; Wilson Memorial High School, Staunton, Virginia.

Keith C. Johnson; Public Schools, Washington, D. C.

Richard W. Schulz; Emmerich Manual Training High School, Indianapolis, Indiana.

Robert Stollberg; President of NSTA; San Francisco State College; San Francisco, California.

Advice Wanted

Two NSTA committees are now requesting suggestions, ideas, and advice from members of the Association.

The committee on nominations and election of officers and directors wants suggestions for nominees for the following positions to be filled in this year's election: president-elect (for president, 1957-58), secretary, treasurer, and directors and alternate directors for Regions II, IV, VI, and VIII. For a listing of states and territories comprising the Regions, see page 15 of the *1955 Membership Directory*. Send your suggestions to the committee chairman, Dr. Ned Bryan, Department of Education, Rutgers University, New Brunswick, New Jersey.

A new committee, termed "The Hoover Committee for NSTA," has been appointed to work during the next two years. This committee will study and recommend on the organizational and administrative structure of NSTA. Of particular concern will be the relationship of NSTA and its affiliated groups (see pages 73-74 of the *1955 Membership Directory*), state education associations, non-affiliated science teaching societies, professional scientific societies, business-industry organizations, etc. Staff organization, dues, and membership services and activities will also come under review. Send suggestions and criticisms, now or later in due course, to the chairman: Ralph W. Lefler, Department of Physics, Purdue University, Lafayette, Indiana. Other members of the committee are: E. Louise Lyons, Steubenville, Ohio; Grace C. Maddux, Cleveland, Ohio; Herbert A. Smith, Lawrence, Kansas; and Dorothy Tryon, Detroit, Michigan.

Flash—NSTA Membership Now Nears 8000! The count prepared as of September 15 by our membership secretary shows a total of 5769 individual members; 1032 elementary schools; 1001 libraries; and 108 members in the Business-Industry Section. Of the total number of individual members, 1152 are life or sustaining members. New York, with a total of 954 individual members, now leads California by 16; Ohio with 527 individual members is challenging Pennsylvania with 575. Most important of all is that this represents a net gain of 1000 members for 1954-55.

SCIENTIFIC TEACHING AIDS AVAILABLE FREE TO TEACHERS

Booklets and teaching aids designed *by* experienced teachers *for* teachers to assist them in showing their students how theoretical science principles are applied on a practical business basis. . . .

Evaluated in advance of publication by members of the National Science Teachers Association.

 # 1. EXPERIMENTS WITH GAS... Booklet of 29 classroom experiments using fuel gas. Includes complete directions, ideas for student participation, etc. Designed for General Science Classes, Junior High School.

 # 2. ADVANCED EXPERIMENTS WITH GAS... 20 advanced classroom experiments to be performed with fuel gas. For Senior High School and Junior College teaching level.

 # 3. SCIENCE IN ACTION... Series of three teaching kits describing the science principles that make each gas appliance possible, together with simple experiments to illustrate the various principles employed, with wall chart and student work sheets. (A) GAS RANGE, (B) GAS CLOTHES DRYER, (C) GAS WATER HEATER. (Kits on Gas Heating, Gas Refrigerators, Gas Incinerators will be available soon and will be mailed when ready to those who desire them.) 7th, 8th and 9th grade teaching level.

 # 4. HOW YOUR GAS METER WORKS... Teaching kit—in simple language with illustrations and diagrams, wall chart and student work sheets. Designed for use at Junior High School level in General and Social Science Classes.

 # 5. NATURAL GAS—Science Behind Your Burner—Teaching kit explaining how natural gas gets from well to burner. Includes teacher's text, 42-frame slide film, (35mm), flow chart and gas pipeline map of the U. S. and Canada, for Junior and Senior High School level.

 # 6. HISTORY OF GAS... A 16-page comic book, for the 4th & 5th grade teaching level.

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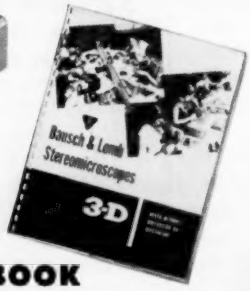

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FSA Activities

What Is FSAF?

The Future Scientists of America Foundation was established by the NSTA Board of Directors in September, 1952. It is the Association's agency for dealing specifically with problems of helping science teachers in locating, supporting, and encouraging science students who show promise of growing into productivity in the scientific endeavor. The FSAF is guided by an Administrative Committee appointed by the president of NSTA. This committee for 1955-56 is:

DR. PHILIP G. JOHNSON, Cornell University, Ithaca, N. Y., *Chairman*
DR. L. EARLE ARNOW, Sharpe and Dohme, West Point, Pa.
DR. HENRY H. ARMSBY, U. S. Office of Education, Washington, D. C.
MR. ROBERT H. CARLETON, National Science Teachers Association, Washington, D. C.
MISS KATHERINE HERTZKA, Hoke Smith High School, Atlanta, Ga.
MR. RICHARD H. LAPE, Amherst Central High School, Snyder, N. Y.
DR. THOMAS H. OSGOOD, Michigan State University, East Lansing, Mich.
DR. JOHN S. RICHARDSON, Ohio State University, Columbus, Ohio
DR. ROBERT STOLLBERG, San Francisco State College, San Francisco, Calif.

What Does FSAF Do?

The FSAF operates and cooperates in programs directed to science teachers and their "gifted in science" students. In its three years of operation to date, the Foundation has:

A. Conducted the annual Science Achievement Awards for Students. Awards by geographic regions (8) and by grade levels (7-8, 9-10, 11-12) go to more than 500 students. Supported by grants from the American Society for Metals, the value of these awards (1955-56) is $10,000. The total ASM grant this year is $15,000.

B. Conducted two West Coast conferences by research teams of 32 science and mathematics teachers. The 1954 conference at Oregon State College explored "New Ideas for School Science Laboratory Exercises" (see February, 1955, issue of *TST*). The 1955 conference at San Jose State College, California, (to be reported in the February, 1956, issue of *TST*) dealt with the math hazards to success in high school science. These conferences have been supported by $10,000 grants from the Crown Zellerbach Foundation.

C. Conducted a research inquiry into the "needs and wants" of science teachers in working with students specially interested and gifted in science. This study was reported in *Encouraging Future Scientists: The Situation.*

D. Produced three editions of *Encouraging Future Scientists: Materials and Services Available.* A bibliography of career information and guidance helps, the current edition will be sent to all NSTA members (8000); additional copies are available.

E. Produced two other booklets to help teachers motivate individual student activity; namely, *If You Want to Do a Science Project,* and *Encouraging Future Scientists: Student Projects.* These booklets are available at 50 cents each or 25 cents each for two or more copies sent to the same address.

F. Produced the booklet, *Careers in Science Teaching.* Single copies or a few available *free,* this booklet is designed to encourage capable high school and college students to consider careers in the teaching of high school science.

G. Encouraged summer employment of science teachers in science-based jobs in industry and laboratories. Over 10,000 contacts have been made (1954 and 1955) with personnel directors and employment offices. Several hundred science teachers were thus helped to "earn and learn." The 1954 program has been reported in *Chemical and Engineering News,* Feb. 21, 1955. An evaluation of the benefits and hazards encountered in the summer of 1955 is now under way.

H. Worked cooperatively with 25 colleges and universities in providing summer research assistantships for science teachers. During the summer of 1955, approximately 35 science teachers were thus placed. An evaluation of this effort is also currently under way. One teacher has already reported that he was offered and has accepted an Associate Professor appointment from his employing institution.

I. Participated in many conferences on "the shortage of scientists and engineers." Groups and agencies with whom FSAF has cooperated in this manner include the Association of Military Engineers, the Research Committee of the National Association of Manufacturers, the Thos. A. Edison Foundation, the American Institute of Physics, and the National Research Council.

J. Provided liaison and consultative services to other

groups and agencies engaged in planning or conducting science teacher-student programs. Examples are the Shell Foundation, National Science Foundation, American Chemical Society, Oak Ridge Institute for Nuclear Studies, and several companies and corporations.

How Is FSAF Financed?

The actual, operating budget of the FSAF arm of NSTA in 1954-55 was about $50,000. The projected budget for the current year is about $60,000. Of this amount, somewhat less than 10 per cent will come from the budget of "NSTA proper." The other 90 per cent or so will come mostly from business-industry organizations whose concern about future scientists and engineers convinces them that a contribution of $500 to $3000, more or less, to FSAF is a good investment. During 1955, contributions of such amounts were received from 54 companies and organizations. This was an increase of 100 per cent over the number of contributors in 1954.

What Gives FSAF Its Appeal?

The outstanding asset behind FSAF is the NSTA membership. Supported by more science teachers than any similar organization in the world and through its departmental status in the National Education Association, NSTA provides communication channels to 28,000 of the nation's high schools and practically all of the 60,000 teachers of science at junior and senior high levels. NSTA's daily contacts and working relations with the associations of secondary school principals, school superintendents, chief state school officers, mathematics teachers, and other NEA units are assets possessed by no other group.

What's Ahead in FSAF?

The 1955 "reporting and planning" conference for FSAF was held September 15 in Washington. For 1956, the FSAF was advised to:

1. Continue, and expand if possible, the Science Achievement Awards for Students.
2. Continue the research-team type Summer Conferences for Science Teachers.
3. Continue the FSAF booklet services; several new titles were suggested.
4. Continue the encouragement of summer jobs and research assistantships for science teachers.
5. Continue the student chart-making contest.
6. Drop the "science teaching ideas" awards for teachers, at least for the present.
7. Launch a science publication for students.
8. Step up the research activities of FSAF.
9. Expand the advisory and consulting role of FSAF.
10. Catalyze development of a name list of all U. S. science teachers.

The New

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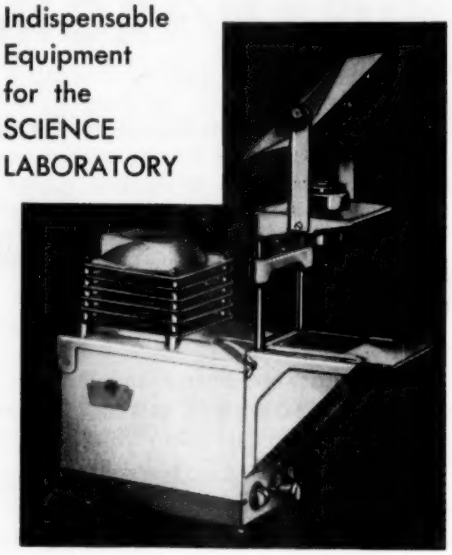

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Book Reviews

THE EARTHWORM, THE FROG, THE HUMAN, Three Unitexts in Biological Science. Albert Wolfson. $3.20 each. Row, Peterson and Company. Evanston, Illinois. 1955.

The design of each of these soft-covered, 6½ x 9½ inch booklets is similar. The climactic feature of each booklet is a set of eight breath-taking color plates on transparent film representing a dissection of the animal—the bullfrog in natural size, the earthworm magnified ten times, and the human trunk reduced to one-fourth natural size. On each plate, the anatomical parts are clearly numbered, the corresponding names being given together with some explanatory notes on the same page below. Someone said about Mendelssohn's oratorio, Elijah, that it was an improvement on the Bible. One might similarly say that these exquisite plates, in a sense, are an improvement on the animals themselves.

In each booklet, the plates are preceded by diagram-illustrated text—the earthworm 20 pages, the frog 11 pages, and the human 20 pages. In each text, a brief motivating statement is followed by a description of the "body plan" of the animal and of its digestive, respiratory, circulatory, excretory, and nervous system. The text ends with a brief discussion of the animal's reproduction, ecology, and evolution.

To expect a satisfying description of an animal's physiology, reproduction, and evolution in twenty pages is to expect the impossible. Of necessity, therefore, the texts leave much to be desired. Oversimplification can be misleading as is, for example, the use of the word "race" for species, or as is the statement that the digestive organs "(1) break down the food into tiny particles (2) transfer these particles to the circulating fluids in the body . . ."

The inside covers are utilized—the front cover to present, in very striking fashion, an overview of the organ systems of the animal, and the back cover to present an equally striking overview of the life cycle.

If it is true, that "a picture is worth a thousand words," the illustrations in these booklets more than make up for the deficiencies in the texts and they render the booklets suitable for both the high school and the college student of biology.

ZACHARIAH SUBARSKY
The Bronx High School of Science
New York, New York

SCIENCE FOR WORK AND PLAY. Herman and Nina Schneider. 154 pp. $1.68. D. C. Heath and Company. Boston, Massachusetts. 1954.

The first volume of the new Heath Elementary Science Series is carefully fitted to the language skills of a first-grade pupil. The activities described, the materials used, and the topics covered are all appropriate to maintain interest.

The first part of the book requires no reading skill. There are captions to be read to the pupils by the teacher. The remaining portion of the text contains a reasonable number of new words introduced at intervals and repeated often enough to become useful vocabulary.

Science topics covered include aspects of health, living things, and brief contacts with light, fire, and weather. The illustrations of scientific principles were chosen from the experiences which a six-year-old would bring to school.

The experiments, or pupil participation activities, are clear as to procedure and should bring about a clearer understanding of the principles being learned. This is true even on those pages which do not contain any words—an achievement for which the authors and illustrators deserve a special word of praise. All of the equipment needed to follow out the suggested experiments will be found in the classroom, or can be easily obtained with little or no expense. This is a fine book to serve as a child's first introduction to the formal study of science.

WILLIAM J. VAN HOUTEN
Northport Public Schools
Northport, New York

JET AIRCRAFT SIMPLIFIED. Charles Edward Chapel. 176 pp. $3.75. Aero Publishers, Inc. Los Angeles, California. 1954.

A new edition of a book first published in 1950 brings one up-to-date in the rapidly changing field of jet and rocket power. After two chapters dealing with general principles of jet propulsion and one chapter on each of the four types of jet engines (athodyd, pulsejet, turboprop, and turbojet), the main portion of the book is devoted to a quite detailed description of the engines currently in production in the United States, and of the planes powered by these engines. The last chapters discuss and describe guided missiles and rocket-powered aircraft. Photographs and diagrams are used abundantly to illustrate the text.

Due to the detail of description of individual engines, it would seem that the widest use of this volume would be as a supplementary or reference book where particular, rather than general information is needed.

JEAN MCGREGOR
McKinley High School
Washington, D. C.

WAIT FOR THE SUNSHINE. Glenn O. Blough. 48 pp. $2.25. McGraw-Hill Book Company, Inc. New York. 1954.

Wait For The Sunshine is the story of spring in Sunfield. Through the eyes of Pete and the farmer, the florist, the miller, and the baker, the children discover the role of sunshine in their lives.

In his usual easy manner, Glenn Blough has presented the essentials of photosynthesis in such a simple way that it should no longer be a problem for either teachers or children.

By using the technique developed in the story of *The House That Jack Built,* Mr. Blough tells the story of a glass of milk, the lumber in a house, and a loaf of bread from the water, carbon dioxide, chlorophyl, and sunshine

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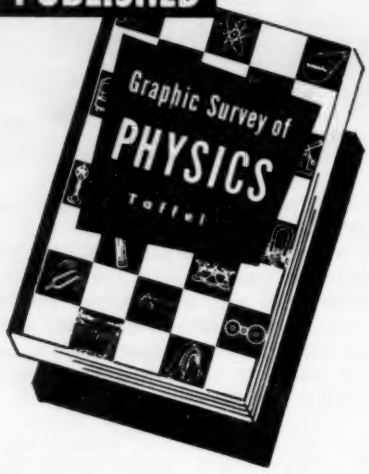

GRAPHIC SURVEY OF PHYSICS

By Alexander Taffel

HERE IS A LONG-AWAITED TEXT in Physics written by a teacher-author who has gained a national reputation for his ability to present this traditionally formidable subject in a form which average students can read with understanding and enjoyment.

GRAPHIC SURVEY OF PHYSICS illuminates the *essentials* of Physics through simple explanation and ingenious visualization. In remarkably compact but authoritative form, it covers basic concepts and facts indispensible for a sound understanding of Physics.

Throughout, the author emphasizes the key importance of Physics in modern life, and its value in understanding our environment.

COLOR is used with rare effectiveness in this text to enhance the teaching power of numerous diagrams and illustrations notable for their clever design and superb execution. COLOR also focuses attention on basic laws and generalizations in the text where it is a means of clarifying and reinforcing ideas.

GRAPHIC SURVEY OF PHYSICS is outstanding for the abundance and quality of its exercise materials which follow each chapter. The text is as up-to-date as a Geiger counter! It presents every development in Physics within the scope of elementary courses, including such topics as *nuclear fission, radar, jet propulsion, three-dimensional movies and television.*

Teachers will find this book unequalled as a compact basic text—one which gives students everything they need. At the same time, it overcomes their natural reluctance to carry and study "big" books. In the low-priced paper edition, it also serves effectively as a supplementary text to clarify the subject throughout the year, and as a means of recapitulation and review.

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THIS DISTINCTIVE, NEW (1954) textbook realistically recognizes the needs and limitations of today's typical beginning students. Designed to meet the requirements of all school systems, it skillfully presents the core material of the ninth-year General Science course, in a compact, well-balanced form.

A wealth of clear diagrams and cartoon illustrations dramatize the subject matter. *Color* is used to highlight key points and enhance teaching power. Ample exercise material follows each chapter.

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WIDELY ADOPTED FOR CLASSROOM USE, this notable text provides a concise, authoritative survey of high school Biology. Teachers testify that even students of limited ability can use this book effectively.

It includes the most recent developments in such fields as *antibiotics, cancer, heredity* and *narcotics.* Many diagrams and cartoon visualizations are used to convey information and dramatize basic concepts. *Color* is employed in the illustrations to emphasize and clarify key material. Classroom-tested exercises are included.

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ACCLAIMED BY SCIENCE TEACHERS throughout the country, this authoritative text is distinguished by a clear, concise style, meticulous accuracy, and sparkling visual material. Emphasis is on *essentials* in driving home key facts and ideas.

This highly usable text presents the most recent advances in chemistry (both theoretical and applied), on a level suitable for high school students. Visualizations with color effectively supplement the text, and clarify important points. Abundant exercise material is provided.

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that were essential for its production. Jeanne Bendick's delightful drawings complement the text.

GRACE C. MADDUX
Assistant Supervisor of Science
Cleveland, Ohio

SCIENCE FOR EVERYDAY USE. Victor C. Smith and B. Bernarr Vance. 737 pp. $3.80. J. B. Lippincott Company. Chicago, Illinois. 1954 (Third Edition).

This comprehensive general science text for use in a one-year course in the 8th or 9th grade will appeal to the busy science teacher who wishes to provide adequate challenges to the better students as well as satisfying experiences to the less gifted. A sufficient number of directed and purposeful activities are suggested in the six well-organized units with their six daily lessons for each of three quarters, so that no extra workbook is necessary.

Up-to-date material on atomic energy, jet planes, and television have been included, but measurement and the new method of artifical respiration seem to have been overlooked. The listing of science principles and related ideas helps to take the emphasis off the learning of facts. The "daily study tests" and the vocabulary lists help to consolidate what has been learned, but the tests might be improved by the inclusion of multiple-choice answers to avoid the vagueness of completion-type questions.

The accompanying Teacher's Handbook contains many helpful suggestions such as lists of appropriate filmstrips and films which may be integrated with the text to provide maximum benefits to the pupils.

PAUL R. DOE
Franklin D. Roosevelt High School
Hyde Park, New York

THE SWANS OF WILLOW POND. Olive L. Earle. 64 pp. $2.00. William Morrow and Company, Inc. New York. 1955.

There are two reasons why this book deserves a place on the shelves of the home and school library. It relates in pictures and words a well-written story about the life of a swan family during one year. It will also be useful as a reference book for children who are curious about the adaptations, habits, and instincts of one species of waterbirds.

JUNE E. LEWIS
State University
Plattsburgh, New York

EXPLORING SCIENCE, BOOK ONE and EXPLORING SCIENCE, BOOK TWO. Walter A. Thurber. (Book One: 160 pp. $1.72; Book Two: 176 pp. $1.88.) Allyn and Bacon, Inc. Boston, Massachusetts. 1955.

These two books are the first to be released in a new, graded elementary science series from Allyn and Bacon. Since these books are intended as part of a series, this review will not be able to analyze certain factors such as continuity, development of concepts through the grades, and total content structure. There are, however, many clues to the usefulness of the series to be found in these two books.

In Books One and Two, Dr. Thurber takes youngsters through experiences in several areas of science. In Book One, there are sections on floating, magnets, color, rain, and several sections on plants and animals. In Book Two, there are sections on thermometers, gravity, mirrors, electricity, machines, wind, and more sections on plants and animals. The topics are treated in a manner designed to help children probe problems in these areas.

A particularly useful aspect of these books is the abundance of activity material. To his credit, Dr. Thurber avoids using the same activities one sees over and over again in so many elementary science series.

Dr. Thurber has intended these books to be used basically and almost exclusively as texts. Therein lies their major limitation, in the opinion of this reviewer. These books cannot be used easily as resource books to help children answer questions independently that arise in the course of other classroom or out-of-school pursuits. They lack enough informational material to help children solve problems that are not directly raised by the text.

The illustrations are clear and the pages uncluttered. The suggestions in the Teacher's Editions are helpful. Dr. Thurber has made a significant contribution to the field in his new series.

J. MYRON ATKIN
University of Illinois
Champaign, Illinois

ALL ABOUT THE INSECT WORLD. Ferdinand C. Lane. 141 pp. $1.95. Random House, Inc. New York. 1954.

Boys and girls in the intermediate and junior high grades will find this book an interesting source of exciting adventure in which they will discover many curious facts about their friends and foes among the members of the insect world . . . from friends who make honey to foes who eat our crops and homes.

Dr. Lane has accomplished the seemingly impossible by presenting in an understandable manner, within the space of only 136 pages, some of the hard-to-believe facts concerning a representative cross-section of the many and varied members of this fascinating branch of the Animal Kingdom.

With 72 two-color illustrations, the book is designed to hold the reader's interest at a high level whether he is a beginner or someone who believes that he already knows "all about the insect world."

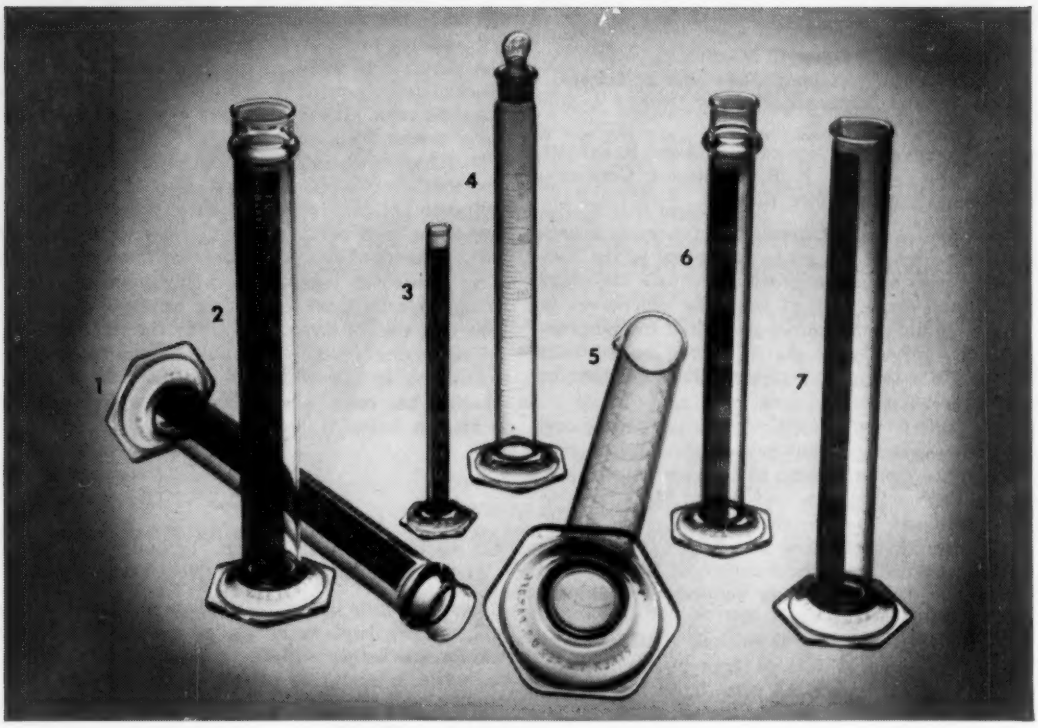
PAUL R. DOE
Franklin D. Roosevelt High School
Hyde Park, New York

INTRODUCTION TO PLANT TAXONOMY. George H. M. Lawrence. 179 pp. $3.25. The Macmillan Company. New York. 1955.

Every college student of biology soon realizes the necessity of adequate classification, and this recent publication, since it points out the need for much additional work in plant taxonomy, should incite workers in its field to renewed efforts. The early pages of the book show several systems of classification, such as Engler's, Bessey's, Hutchinson's, and others. This well serves as a basis for the statement, "There is no universally accepted definition of what a species is." The chapter on "Plant Structures" is especially good. Chapter VIII is of special interest to teachers who like a historical approach to science.

This book can well be used in such courses as basic biology, general botany, and plant taxonomy. The glossary of approximately 1200 defined terms is a handy reference.

FRED A. HANAWALT
Otterbein College
Westerville, Ohio



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Audio-Visual REVIEWS

PLATINUM METALS. 50-frame filmstrip, 1955. B & W. Available free from the Audio-Visual School Service, 48 E. 29th St., New York, N. Y. Sponsored by the International Nickel Company.

Recommendation: Suitable as enrichment material in general science, chemistry, or social studies.

Content: Shows the importance and varied benefits derived through the use of the Platinum Group metals in everyday life. It visualizes the history that led to the discovery, separation, and utilization of this group of metals. The historical portions of the filmstrip are largely photographs of dioramas created in the preparation of an educational exhibit on the platinum metals which was shown for more than a year at Philadelphia's famous Franklin Institute.

Evaluation: The organization was not very good. It was felt that at best this material might be used only for supplementary study or to furnish some historical background in chemistry. A Teacher's Guide is included.

◇ ◇ ◇

HONEYBEE: A SOCIAL INSECT. 6 min. sound, 1955. $27.50 B & W, $55 Color. Coronet Instructional Films, Coronet Building, Chicago, Ill.

Recommendation: Suitable for biology and general science classes on the junior and senior high school levels.

Content: Honeybees are seen as a typical example of social insects in that: (1) they cooperate with each other; (2) there is a division of labor; (3) they live together in a common community. While observing these characteristics, the film shows the activities of the bees, their complete metamorphosis, and their economic importance.

Evaluation: The film used excellent photography for many close-ups of the activities of the insects. Although the black and white version is good, color would be very valuable. Well organized and presented, but the sound was poor and hard to understand. A Teachers' Guide accompanies the film.

◇ ◇ ◇

CHARACTERISTICS OF PLANTS AND ANIMALS. 11 min. sound, 1954. Color. Audio-Visual Center, Indiana University, Bloomington, Ind.

Recommendation: Excellent for use in introductory biology at the high school level. May also be used in general science in junior high school.

Content: One of the "Continuity of Life" series of films. Shows the reason why spontaneous generation of life was first accepted, and then illustrates Pasteur's experiment to show that life develops only from other life. The life processes: motion, sensitivity, reproduction and growth, and food-getting are compared in plants and animals. The film concludes with a review of cells and their functions.

Evaluation: Very well put together and interesting to view. Should be valuable as a discussion stimulant in introducing the concepts above to a class starting this unit. Photography and sound are good.

◇ ◇ ◇

ASEXUAL REPRODUCTION. 11 min. sound, 1954. Color. Audio-Visual Center, Indiana University, Bloomington, Ind.

Recommendation: Excellent for high school classes in biology. Could be used as a general introduction and as a part of a unit dealing with reproduction.

Content: One of the "Continuity of Life Series" of films. Illustrates the unbroken line of ancestry from ancient times by showing briefly the evolution of the horse. Explains sexual reproduction by showing the union of gametes. Asexual reproduction is discussed in terms of: fission; outgrowths, such as budding, runners, underground stems, and cuttings; and spores. It concludes by showing how some plants and animals reproduce by both methods.

Evaluation: Very good film; interesting and informative. Should be the basis for excellent discussion. Should stimulate much interest in a topic in which students are very interested.

◇ ◇ ◇

AIR ALL ABOUT US. 11 min. sound, 1955. $55 B & W, $110 Color. Coronet Instructional Films, Coronet Building, Chicago, Ill.

Recommendations: Suitable for science and social studies in the primary and intermediate levels of the elementary school.

Content: Introduces basic concepts about the physics of air. While watching a feather float downward, David becomes aware of the ocean of air surrounding the earth. In experimenting with a balloon, he learns that air exerts pressure in all directions. This information helps him explain the use of air pressure in suction cups, bicycle and automobile tires, a car lift, and an airplane wing lift. It emphasizes that air all around us can be put to use in many ways.

Evaluation: Excellent content and organization. Photography and sound are good. Should stimulate much discussion among children introduced to these topics. A Teachers' Guide accompanies the film.

◇ ◇ ◇

MIRACLE OF MOLD. 9 min. sound, 1954. $35 B&W. Sterling Educational Films, 205 E. 43rd St., New York 17, N. Y.

Recommendation: Most useful for grades nine through twelve. Could be used with units on Microbiology, Molds, Disease, Research in Science, and in vocational counseling.

Content: Shows the discovery of terramycin and the application of large scale manufacture to its production for the medical and agricultural world. Demonstrates the primary tests on many soil samples to isolate an antibiotic. Shows the standardization of dosage on chick embryos. Explains the use of this drug in disease control and as a nutritional supplement for meat animals.

Evaluation: This film seemed to stress the values and contributions of the pharmaceutical industry to excess. Some members felt that this was excess advertising. The film could be used for general showing to adult groups, as well as for schools. The photography and sound were average. Content was well organized, and the presentation was good.

Activities of NSTA AFFILIATES

► The CONNECTICUT SCIENCE TEACHERS ASSOCIATION has scheduled a meeting for October 28 in Bridgeport. The Association is fortunate in having as speaker for the meeting Dr. Paul Brandwein.

CSTA has in the mill two publications. The first, *Proceedings of the First Connecticut Conference on the Teaching of Science,* comes as a result of the highly successful conference held last April. With the theme, "A Growing Science Curriculum for the Growing Child," the conference encompassed all grade levels of science teaching. Robert Cohen, of Wesleyan University, will edit the second booklet, *Science in Our Culture:* A Bibliography in the History, Philosophy, and Social Aspects of Science for Schools and Colleges. Wesleyan University is cooperating on the project by printing both booklets at no cost.

► Many of the members of the DETROIT BIOLOGY CLUB will travel to Higgins Lake Conservation Training School Headquarters, Roscommon County, the week-end of October 27. Here they will take part in the Biology, Conservation, and Elementary Science section programs of Region 1 and 2 of the Michigan Education Association. The theme for these meetings will be, "Our Conservation Heritage, Whose Responsibility to Tell the Story?" There will be discussions by experts in the field on how to inform citizens about conservation goals and practices through the use of television, radio, newspapers, magazines, the classroom, and field trips.

► The WEST VIRGINIA SCIENCE TEACHERS ASSOCIATION is working with the Oak Ridge Institute for Nuclear Studies in planning and conducting a workshop on science fairs. The workshop will be held in November. NSTA has endorsed the program and is supplying the dinner speaker. Our representative will be Professor John B. Chase, Jr., of the University of Virginia.

► Recently NSTA has embarked on an effort to establish contacts with more state and local science teacher associations. Working largely through State Directors, NSTA hopes to improve communications and working relationships with more local groups. Also, through this effort, state science associations will be alerted to the possibility of affiliating with NSTA.

► The FLORIDA ASSOCIATION OF SCIENCE TEACHERS has recently accepted responsibility for coordinating all science fair activities in the state. The proposed plans call for a steering committee composed of three university members and five FAST members. The state will also be organized into district and local committees to meet the needs of individual communities on elementary, secondary, and college or university levels.

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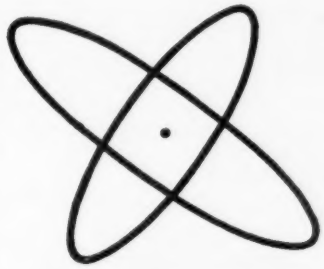

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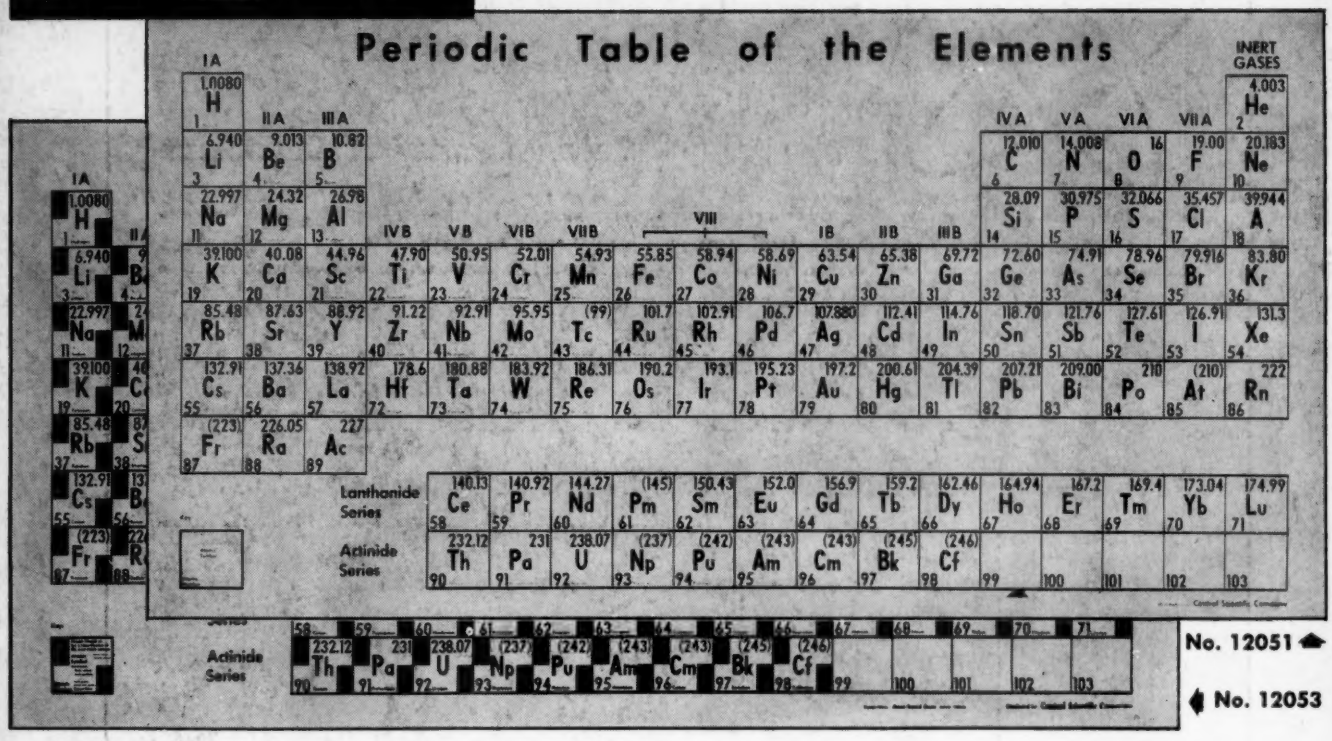

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